PROPUESTA TFM CURSO 2020-2021

Structure of shade canopy and its effect on light availability in cocoa (*Theobroma cacao* L.) production systems.

Description:

The implementation of agroforestry systems based on cocoa plantations (*Theobroma cacao* L.) (C-AFS, hereafter) might result in agro-ecological improvement, increase of biodiversity and soil quality associated with higher yield and food security. Sustainable cocoa-agroforestry management needs to conserve a diverse layer of multi-purpose shade trees. In principle, appropriate shading in C-AFS leads to relatively high photosynthetic rates, growth, and seed yield. Overall, increasing shade levels in C-AFS seem to promote biodiversity, carbon sequestration and ecosystem services. However, this is a very simple assertation given the diversity of C-AFS worldwide and the important implications it has with cocoa productivity in relation to other environmental factors (e.g. soil, water) in a context of global change. Thus, actual optimal shade levels are arguable and vary depending on the target and context of the C-AFS used. The current agroforestry trial implemented by Mondelēz International and Barry Callebaut in Tiassalé (Côte d'Ivoire) was designed to fill this gap by gathering empirical data on cocoa production, environmental and economic benefits in three pilot agroforestry planting schemes with different cocoa planting species composition/arrangement/design and densities.

The main objective of this student project is to complement and validate simple projections of shade available for cocoa trees across the C-AFS typologies established in Tiassalé. Shade values have been estimated using two available models (SExiFS and ShadeMotion). The student project will evaluate and compare those values with real estimates of light availability from hemispherical imagery and potentially Terrestrial LiDAR (dependent on future field work). Students with interest in modelling and applied research are encouraged to contact us to adapt the project to their interests. Proficiency in English is recommended but not compulsory.

Example:
Suárez Salazar, J. C., Ngo Bieng, M. A., Melgarejo, L. M., Di Rienzo, J. A., & Casanoves, F. (2018). First typology of cacao (Theobroma cacao L.) systems in Colombian Amazonia, based on tree species richness, canopy structure and light availability. *PloS one*, *13*(2), e0191003.

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