Mapping tropical forest diversity from multi- and hyper-spectral imagery

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Tropical forests are receiving increasing attention given the rapid loss of biodiversity due to the combined action of global warming and increasing anthropogenic pressure. There is a need to go beyond monitoring deforestation and to set up monitoring systems capable of assessing tropical forest degradation in terms of biodiversity.

We use a botanical inventory where each trunk is identified on the ground as well as a partial inventory of the crowns segmented by LiDAR data on very high resolution images to explore the relationships between spectral and biological diversity (taxonomic and functional) in neotropical forests and its sensitivity to spectral and spatial resolution to help clarify the relevance and scope of a future hyperspectral satellite mission heralding an observation system to monitor the evolution of forest biodiversity.

Hyperspectral data, because of their high dimensionality, are complex: methodological needs are mainly related to the quality of the estimators and their resistance to noise, due to spectral and spatial variability of the observed elements. Therefore, we need to find the right approach to be able to make the link with the diversity measured on the ground and to determine what can be measured via spectral diversity.

The choice of a diversity metric requires a preliminary analysis in order to have a robust interpretation of the signal: knowing what is being measured when measuring pixel scale spectral diversity and what are the factors and components of spectral diversity. In a first analysis, we aim to estimate the intraspecific variability of species and delineated crowns and characterize the contribution of SWIR data on species inter/intra variability and separability.

Keywords: Hyperspectral ; LiDAR ; tropical forests ; modeling

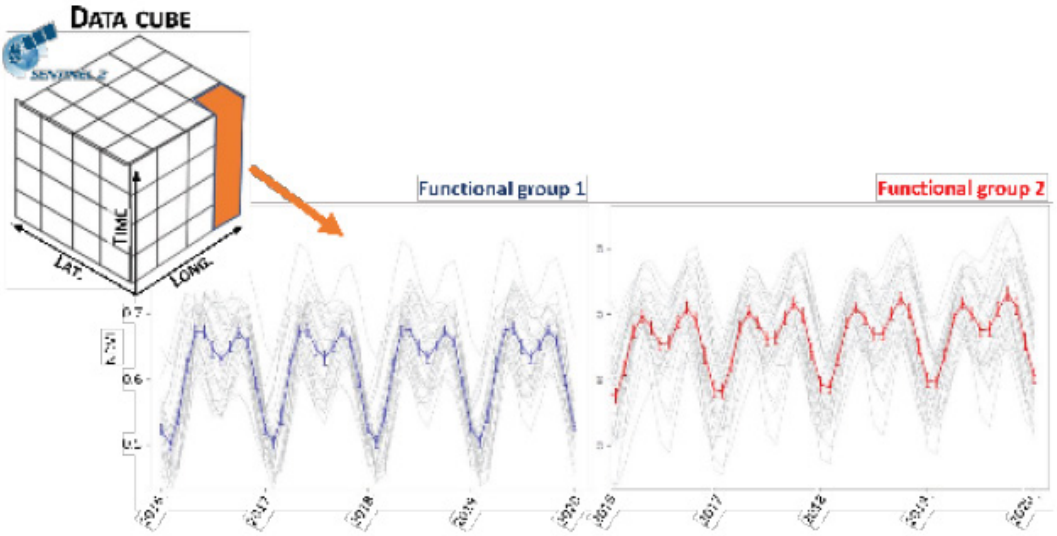

Figure 1. Time series of the spectral index «NDVI» (Sentinel-2 sensor) for two functional groups (red and blue)

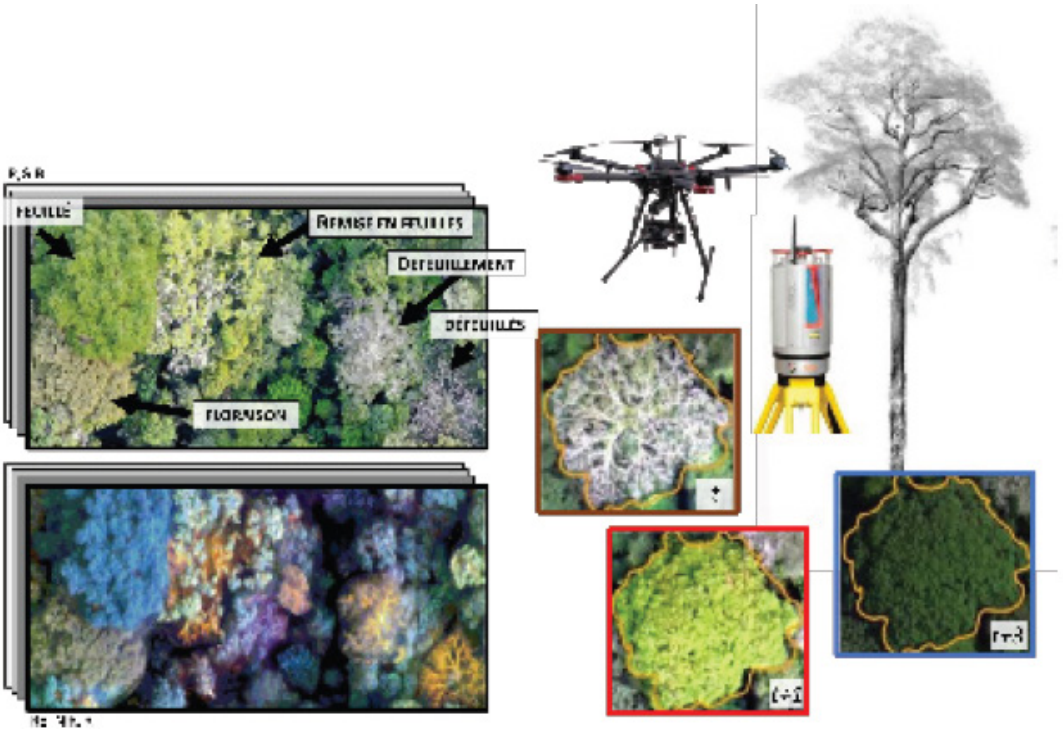

Figure 2. Repeated acquisitions of multispectral and LiDAR data allow following phenological events at the crown scale in order to better interpret the satellite signal.