Quantification of Vertical & Horizontal Forest Structure using UAS LiDAR: Impacts of Succession, Seasonality & Liana Infestation in a Tropical Dry Forest

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Light ranging and detection (LiDAR) technology has played an integral part in large scale forest inventory and assessment. More recently, the push for airborne LiDAR technology into smaller scales has resulted in the integration of LiDAR and unoccupied aerial systems (UAS) or also known as drones. At the plot level scale, a more detailed description of the forests structure can be acquired. Forest structure is an important part in determining the type of services a forested ecosystem can provide and the quantity or quality of these services. The structure of a forest is split into 2 main vector components: Vertical and Horizontal. Vertical structure will include metrics such as simple height distribution, as well as more environmentally descriptive metrics like leaf area density (LAD) and its summation leaf area index (LAI). Vertical structure can be closely tied to the forest stand age and stage due to tree growth. Horizontal structure can be much more difficult to described, because of this the horizontal structure is often simply the spatial distribution of the vertical structure attributes such as canopy roughness. Due to the dynamic nature of forests, it is expected that the forest structure may shift with influences such as succession, seasonality and more specific to this research liana infestation.

This research focusses on the application of UAS-based LiDAR for the purpose of quantifying forest structure as a function of succession, seasonality and liana infestation. The research takes place in the Santa Rosa National Park located in the Guanacaste region of Costa Rica. Through the quantification of various LiDAR-based metrics and combination of plot level inventory data we compared the plot structure related to succession, seasonality and liana infestation. Succession proves to be the most notable influence, as this in the main descriptor of forest height, stand density and overall biomass meaning that as a forest progress in succession metrics such as LAI should increase. Seasonality provides a different form of change in forest structure, due to the loss of leaves in TDF during seasonal shift, the structure during this time is a function of woody mass abundance. Finally, infestation shows a complex nature with structure because of its relationship with succession suggesting that liana influence on structure may be muted in certain forest stands. Further research is required to determine the *in-situ* impacts of lianas on a smaller scale.