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# Exploration of in-situ light and biomass estimation by digital hemispherical photography in tropical forests

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Digital hemispherical canopy photography (DHP) is a close-range remote sensing technique for quantitatively studying plant canopies via photographs acquired through a hemispherical (fisheye) lens. The digital technique has become quite popular the last decades for in situ biomass and light regime estimation in agricultural and forest ecosystems with a lot of studies in temperate and boreal forest ecosystems, but is relatively unexplored in tropical forest ecosystems' applications.

Therefore, this study focuses on the potential of biomass and light regime estimation using hemispherical photography in a tropical forest. The field study is the 16-ha Luquillo Forest Dynamics Plot, a tropical forest in the Luquillo mountains of north eastern Puerto Rico. The plot encompasses areas of differing intensities of past human disturbance and in addition the region has been hit by two major hurricanes since 1989. Analyses of this forest plot are used to assess shifts in the relative importance of land-use history, biotic and abiotic variables, as the forest recovers from hurricane damage. A time series of hemispherical images has been acquired on a biannual basis over 10 years (1997-2007) using a systematic grid sampling strategy in the forest. These results will be used to predict forest regrowth and will have implications for forests throughout the tropics that will likely experience increases in hurricane disturbance and human impacts in the coming decades.

In this study, the time-series dataset has been analyzed using different commonly used automatic thresholding and LAI inversion algorithms, in order to test the algorithms' performance and capability for biomass and light regime (change) estimation. The study has as main goal to detect potentials and limits in use for typical tropical forest regimes.
Overall, the hemispherical photography technique has shown to be a possible reliable tool for in situ biomass and light regime estimation in tropical forest ecosystems, but caution should be held. The limits of the algorithms are discussed and the results corroborate the hypothesis that the biomass and light regime estimates become less reliable in case of high LAI values.