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Interactive comment on "Effects of topography, soil type and forest age on the frequency and size distribution of canopy gap disturbances in a tropical forest" *by* E. Lobo and J. W. Dalling

Anonymous Referee #2

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This paper describes a study characterising the factors affecting the size class distribution of canopy gaps and the fractional area in gaps in the tropical forest on Barro Colorado Island, Panama. The authors made innovative use of LiDAR to generate these metrics and benefited from data layers for environmental covariates to fit models that estimated the impacts of forest age, soil type and slope. Determining the distribution of forest in gap phase is important to studies of biomass accumulation, and forest community composition and dynamics, therefore this paper has broad appeal for tropical community and ecosystem ecologists. The paper is generally well-written, but various aspects of the approach remain unclear and require further clarification.

Forest age is a fundamental variable addressed by the paper, and the authors allude

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to a long history of research on BCI enabling them to map forest age at a high degree of spatial resolution (Figure 1a). However it is unfortunate that there is no description or critique of the techniques used by previous authors to determine forest age, which is required to justify confidence in the high spatial resolution inferred by this study (Enders 1935 is not available to me). It is particularly important to convince readers that previous researchers did not infer forest age based on forest structural criteria (which is a perfectly valid technique, but would then require circular reasoning for Lobo & Dalling to use the forest age data in models explaining one element of forest structure). There is also an unexplained disparity between the age classifications claimed by the original authors (apparently five age classes) and the coarser resolution adopted in this paper (old growth vs old secondary). If you're confident in the original authors' classifications, why abandon the opportunity to analyse at higher temporal resolution ? If you're not confident in those classifications, then is the 1 m2 spatial resolution justified ?

Second, I'm puzzled as to why the authors chose a canopy height threshold of 5 m for defining gaps. I appreciate the choice is essentially arbitrary, and as they point out one limitation of prior work is that different authors have used different height thresholds, but at least one well-cited author (Brokaw) applies a threshold of 2 m and it's a shame this paper doesn't take the open opportunity to determine the sensitivity of their conclusions to variation in this threshold – an obvious methodological assumption that could be tested.

The method for defining gap area also needs more complete description and justification. In the sentence "all contiguous 1 m2 quadrats with a canopy height ..", does the definition of contiguous imply that the quadrats are adjacent and share a common edge, while adjacent quadrats that only share a common corner are not contiguous ? Thus a quadrat can only be contiguous with a maximum of four adjacent quadrats, and not eight ? On the ground, real gaps are often broken up by relict trees and overtopping crowns that break-up their contiguity based on vertical-projection methods for defining gaps (which is why some authors extend their concept of a gap to include an

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area up to the base of adjacent large trees). Again, testing the sensitivity of the models to different approaches to defining gaps would have provided interesting methodological context.

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