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The effects of topography on gap distribution in a tropical moist forest, Brazil

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The natural formation of gaps is a crucial process in the ecology of topical forests. Gaps may enhance the environmental heterogeneity at spatial and temporal scales, resulting in floristic and structural mosaics of different ages and sizes. Some studies have suggested that tree individual mortality across elevational gradients is related to topography and tends to increase as terrain becomes steeper. This study evaluates the effects of topographical variation on the distribution of gaps in a tropical moist forest (Atlantic forest, SE Brazil) along an elevational gradient. Questions include: What is the relationship between gap distribution and topography? How the number and size of gaps (average and total gap area) vary as a function of slope? Using a spatial positioning dataset of live trees and palms with diameter ≥ 5 cm, we mapped and estimated the area of all forest gaps in 12; 1-ha permanent plots distributed along the gradient (10 - 1100m asl). We defined gaps as the surface area directly under a canopy opening, extending to the base of edge trees. We set the minimum detectable size of a canopy gap ($20m^2$) by fitting gap length (L) and width (W) to the ellipse formula, and using a threshold of 5 m as the minimum distance between live stems (for L and W). The number of canopy gaps extended from 28 up to 43 gaps ha^{-1} along the elevational gradient. Total gap area showed a 2.5-fold variation among plots (1497 - 3711 m^2 ha^{-1}). Although we found a negative trend between total gap area and average gap size with slope, those relationships were not statistically significant. Our results suggest that the processes controlling the canopy openness pattern for the coastal Atlantic forest in Brazil are complex, and may be also linked to the local dynamics of tree death and recruitment.