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## Inter-Relationships Between Canopy Openness and Vegetation Diversity in Tropical Rainforests of Sri Lanka Across a Wide Altitudinal Gradient

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As light transmission is essential for plants in the forest under story, canopy openness (CO) could be closely related to vegetation diversity in tropical rainforests. This study investigated the variation of CO of wet zone rainforests in Sri Lanka along an altitudinal gradient and its relationship to the Shannon-Wiener vegetation diversity index ( $H'$ ) and species richness ( $R$ ). CO was quantified as the fraction of visible sky ( $V_{sky}$ ) in canopy hemispherical photographs (HCPs). Ten Permanent sampling plots (PSPs) of one hectare was established along an altitudinal gradient from 117 m to 2132 m above mean sea level. Nine HCPs were obtained covering the entire 1 ha plot and canopy properties were calculated by Hemiview image analysis software. Plot-level means of  $V_{sky}$  and leaf area index (LAI) showed highly-significant ( $P < 0.0001$ ) variation among PSPs. Sinharaja-Pitadenitya at 618 m had the lowest  $V_{sky}$  and the highest LAI whereas Pidurutalagala at 2080 m had the highest  $V_{sky}$  and the lowest LAI, with a highly-significant negative correlation ( $P < 0.0001$ ;  $r = -0.784$ ) between  $V_{sky}$  and LAI.  $V_{sky}$  and LAI showed respectively negative and positive second-order polynomial trends with altitude across its whole range. Vegetation diversity ( $H'$  and  $R$ ) showed highly-significant ( $P < 0.0005$ ) linear decrease with increasing altitude.  $V_{sky}$  showed negative second-order polynomial relationships with  $H'$  and  $R$ . Increasing  $H'$  and  $R$  decreased  $V_{sky}$  from 2132 to 509 m as increasing vegetation diversity increased LAI and reduced CO. However, this trend was reversed from mid- (*ca.* 500 m) to low (*ca.* 100 m) altitude where both CO and diversity increased. Vegetation diversity has probably increased at the lowest altitude (Kanneliya) because of greater CO and the resulting transmission of light to the ground level. Based on these results, it is concluded that whereas CO acts as a determinant of vegetation diversity at lower ( $< 500$  m) altitudes, at higher altitudes ( $> 500$  m), vegetation diversity determines CO.

**Keywords:** *Canopy openness, Shannon-wiener diversity index, Species richness, Tropical rainforests, Visible sky fraction*