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The Influence of Vegetation Characteristics in Regulating the Microclimate in the Knuckles Conservation Forest, Sri Lanka

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Abstract

Microclimatic variables, which vary spatially and temporally across landscapes, are largely influenced by vegetation characteristics. This study was conducted at the end of February 2023 in the northern region of the Knuckles Conservation Forest in Sri Lanka, with the aim of investigating the role of vegetation characteristics on microclimatic metrics in grasslands (GR) and sub-montane forests (SMF). Ambient temperature (T) and relative humidity (RH) were measured using sensors placed 2 m above the ground at randomly selected locations in sub-montane forests (n=9) and grassland patches (n=10). Canopy cover (CC), herbaceous cover (HC) and girth at breast height (GBH) were recorded at each site within 10×10 m quadrats centering the sensors. The study demonstrated a significant difference in the CC (P<0.05) and GBH (P<0.05) between the two habitats. Conversely, no significant difference was found in the HC between the habitats. The regression analysis showed that the contribution of HC to microclimate regulation was low ($R^2 \approx 0.0$, $P > 0.05$). In contrast, CC had a significant and positive influence on T min ($R^2 = 47.5$, $P < 0.05$) and RH min ($R^2 = 50.0$, $P < 0.05$), and a significant negative influence on T max ($R^2 = 45.4$, $P < 0.05$), T range ($R^2 = 73.2$, $P < 0.001$) and RH range ($R^2 = 40.6$, $P < 0.05$). The presence of large trees also significantly contributed to these proxies showing a negative relationship with T max ($R^2 = 64.2$, $P < 0.001$), T range ($R^2 = 79.1$, $P < 0.001$), and RH range ($R^2 = 54.9$, $P < 0.05$) and a positive relationship with RH min ($R^2 = 71.7$, $P < 0.001$). This study demonstrates that increased canopy cover and GBH can play a significant role in buffering microclimate extremes, highlighting the importance of maintaining vegetation cover, which is particularly relevant in the face of predicted climate change.

Keywords: Microclimate, Sub-montane forests, Canopy cover, GBH, Sri Lanka