

Light reduction by regional haze and its effect on simulated leaf photosynthesis in a tropical forest of Malaysia

ABSTRACT

The general level of haze has increased rapidly in tropical regions over the last decades. To reveal the effects of haze on tropical forest ecosystem, photosynthetic photon flux density (PPFD) at the top of and within a tropical forest canopy was measured on days with and without visible haze, in the Pasoh Forest Reserve, Peninsular Malaysia. Total daily PPFD at 40 m aboveground on hazy days was only about 50% of that on the days without visible haze. The reduction of PPFD on hazy days was much larger at 50 cm aboveground within the forest. During the period with haze, the forest understory received few PPFD higher than 50 $\mu\text{mol photons m}^{-2} \text{s}^{-1}$. Photosynthetic carbon gain was estimated to examine the potential effect of PPFD extinction by haze. Under hazy conditions, the simulated net carbon gain, which included photosynthetic carbon gain of daytime and respiratory carbon loss at night, decreased to about 6 $\text{mmol CO}_2 \text{ m}^{-2}$ for an average shade leaf of understory plants. This marked decrease of leaf carbon gain might have important impacts on the growth and survival of understory plants, and therefore on the regeneration of tree species in the tropical forest.

Keyword: Radiation; Regeneration; Sunflecks; Tropical ecosystem