

Leaf litter decomposition and soil carbon dioxide fluxes across climatic gradient in tropical montane and lowland forests

ABSTRACT

Leaf litter decomposition and soil respiration are of great interest in climate change studies due to their roles in recycling carbon and nutrients. These processes can be markedly different in tropical montane and lowland forests. Litterbag technique was used to determine the decomposition and nutrient dynamics of leaf litter in two different tropical forest types in Pahang, Malaysia for 480 days. Soil CO₂ fluxes were measured periodically for up to 360 days. Mass loss, total C, N, S, P, K, Mn, lignin, cellulose as well as C:N and lignin:N dynamics of decaying leaves were quantified. Various mathematical models and regression analysis were used to describe litter mass loss trends. Rapid decomposition ($k: -0.004 \text{ day}^{-1}$) and weight loss (> 80%) took place in the lowland forest compared with the montane forest. Significant linear regression relationships between mass loss and litter quality were obtained for all sites except for cellulose (montane forest). Low soil CO₂ fluxes (two to three folds) and 38% slower decomposition due to reduced soil and air temperatures were found in the montane forest, suggesting its role as potential temporary C sink. Decomposition rate, C:N, lignin:N and soil respiration can be used as potential indicators to predict C balance in forests.

Keyword: Litter decay; Carbon cycle; Soil respiration; Tropics; High altitudes