Soil carbon dioxide efflux and atmospheric impact in a 10-year-old Dipterocarpus recovering lowland tropical forest, Peninsular Malaysia

ABSTRACT

The recovering logged-over forest ecosystem increases the CO2 efflux into the atmospheric carbon pool in response to environmental factors to changes in the soil temperature and moisture. These CO2 outbursts can have a marked influence on the ecosystem carbon balance and thereby affect the atmospheric carbon pool. The study was conducted in the 10-year-old logged-over forest of Sungai Menyala forest, Port Dickson, Negeri Sembilan, Malaysia. The measurements of soil CO2 efflux were conducted using the continuous open flow chamber technique connected to a multi gas-handling unit and infrared CO2/H2O gas analyser. The aim of this study was to determine the soil CO2 efflux and the environmental variables and likewise the impact of environmental factors on soil CO2 efflux. Post-hoc comparisons were made using the Tukey test ($p < 0.05$), and multiple linear regression to determine the impact of environmental factors on soil CO2 efflux. Soil CO2 efflux ranged from 100.22-553.40 mg m-2 h-1 with the highest efflux in the afternoon attributed to an increase in soil temperature and low moisture. A higher soil temperature and low moisture signify an influential factor as the forest is recovering from logging activity. Furthermore, the predictor environmental variables: SOC (soil organic carbon), TOC (total organic carbon), SMC (soil moisture content), Bulk Density, SOCstock (soil organic carbon stock), TAGB (total above ground carbon biomass), Below Ground Carbon Biomass, soil pH, Nitrogen to Carbon ratio account for the spatial and temporal variation in soil CO2 efflux into the atmosphere. The analysis revealed a strong correlation between soil CO2 efflux, changes soil properties and environmental factors with an R2 more than 0.80 at $p < 0.01$. This is proven that logging activity accounts for the changes in environmental factors to influence soil CO2 efflux rate within 10-years of logging and forest recovering.

Keyword: Biomass; Forest ecosystem; Carbon pool; Carbon sink; Soil CO2 efflux