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## Microbial and Chemical Soil Properties of Secondary Forest Soils with Different Vegetation and Stand Age in La Union, Philippines

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### Abstract

We investigated six sites with the aim to assess the effects of tree plantations with different species and different stand age (18 months to 40 years) on biological functions such as soil organic matter accumulation and especially on the activity, biomass and community structure of soil microorganisms.

Soil pH, clay content and cation exchange capacity, have neither significant effects on microbial biomass and activity indices. In contrast, soil organic matter and microbial properties were highly interrelated with correlation coefficients between  $r=0.51$  (ergosterol and total N) and  $r=0.90$  (biomass N and soil C). Although all soil organic matter and microbial properties are within the range described in the literature, our six forest sites reveal several interesting and important differences: Average ratios of biomass C-to-soil C were 2.8%, biomass N-to-total N 2.0%, biomass C-to-N 14.1%, ergosterol-to-biomass C 0.19%, ATP-to-biomass C  $4.3 \mu\text{mol g}^{-1}$ . AEC and metabolic quotient  $q\text{CO}_2$  reached average levels of 0.71 and 36 ( $\text{mg CO}_2\text{-C d}^{-1} \text{g}^{-1}$  biomass), respectively. The maximum biomass N-to-total-N ratio was observed at the Calliandra site in combination with maximum AEC,  $q\text{CO}_2$ , ergosterol-to-biomass C ratio, and a minimum biomass C-to-N ratio. The soil C-to-N ratio showed a significant positive correlation with the biomass N-to-total-N ratio and a negative with the ATP-to-biomass C ratio. However, the strongest relationship was found between the ratios of biomass N-to-total N and the ergosterol-to-biomass C, followed by that of biomass C-to-soil C and biomass C-to-N. Also a significant, but negative correlation revealed the biomass C-to-N ratio and the  $q\text{CO}_2$ . The AEC was positively correlated with the  $q\text{CO}_2$  and the biomass N-to-total N ratio with similar levels of significance.

**Keywords:** AEC, ATP, biomass C, biomass N, ergosterol, respiration