

EFFECT OF LAND-USE SYSTEMS AND SEASONAL VARIATION ON MICROBIAL BIOMASS AND POPULATION IN TROPICAL RAINFOREST SOILS



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ABSTRACT

Ecosystem degradation could result in land-use change and alterations in soil physical, chemical and/or biological properties. Soil microbial population plays important role in ecosystem functioning, as they decompose organic matter and determine the release of nutrients in the soil. The effects of land-use systems, seasonal variations and soil depths on microbial biomass and population in Oluwa forest reserve, Nigeria were investigated. Soil samples were obtained from two soil depths (0–15 and 15–30 cm) from primary forest, degraded forest, plantation forest and agricultural land during the rainy and dry seasons as well as their transitions. Plate count method was used for microbial population determination while fumigation–extraction method was used for microbial biomass carbon (MB-C) and nitrogen (MB-N). One-way analysis of variance (three-factor factorial) was used to test for significant difference and interaction among the factors. In all the ecosystems and soil depths, MB-C and MB-N ranged from 50.63–125.45 $\mu\text{g g}^{-1}$ and from 7.51–18.62 $\mu\text{g g}^{-1}$, respectively during rainy season and from 26.76–97.13 and 3.79–14.41 $\mu\text{g g}^{-1}$ during dry season. Land-use system, soil depth and seasonal variation significantly affected microbial population, MB-C and MB-N. The trend was: primary forest > *Gmelina* plantation \geq degraded forest > agricultural land for land-use system; peak of rainy season > onset of rainy season \geq onset of dry season > peak of dry season for seasonal variation and 0–15 cm > 15–30 cm for soil depth, thus revealing that increased ecosystem degradation led to increased soil microbial indices degradation. The results also revealed the influence of investigated variables on microbial indices and by implication on source or sink of nutrients, nutrient conservation and cycling and soil primary productivity. The higher microbial indices of the forested ecosystems explain why farmers encroached into the forest in search for fertile land and tend to suggest more imminent encroachment. Implications of the results for land-use systems were discussed.

Keywords: Soil microbial population, Soil microbial biomass, Land-use systems, Primary forest, Degraded forest, Forest plantation