ABSTRACT

The main aim of this research project was to study the physico-chemical characteristics (moisture, temperature, pH, conductivity, CEC, organic matter content , total nitrogen content, C:N ratio, available PO_4^-, NO_3^- and NH_4^+) and the microbial aspects (microbial biomass, soil respiration, nitrogen transformation including nitrogen mineralization rate, nitrification rate, abundance of nitrite oxidizers, ammonia oxidizers, denitrifiers and nitrogen fixers) of the soils of the montane rain forest (MRF), lowland rain forest (LRF) and the dry mixed evergreen forest (DMEF). of Sri Lanka. For this perpose the top layer of soils (0 - 7cm) of these three forests were collected in the dry and wet seasons.

DMEF soil had the lowest moisture content and showed a slight seasonal change during dry and wet seasons. LRF and MRF soils had higher moisture contents throughout the year and among these two soils, the LRF soil had a relativly low moisture content.

LRF and MRF soils had acidic soils (3.1 - 4.7 pH and 3.5 - 4.4 pH respectively) while DMEF soil had a near neutral soil (5.6 - 6.6 pH).

The MRF had the lowest soil temperature, while the DMEF had the highest soil temperature. The three soils showed only slight seasonal fluctuations in this respect.

MRF and LRF soils had low available PO_4^- contents throughout the year, while the DMEF had the lowest during the wet season. DMEF soil showed the highest PO_4^- content in the dry season. PO_4^- contents positively correlated with soil pH and soil temperature.

DMEF and LRF soils had low organic matter contents while the MRF soil had a high organic matter content. Soil organic matter accumulation with increasing altitude and negative correlation between organic matter and the soil temperature was noted.

Cation exchange capacities correlated with organic matter contents of the soil in all the three forests examined. CEC was high in MRF soil while it was low in both DMEF and LRF soils.

MRF and DMEF had high contents of total nitrogen. Total nitrogen changes with rainfall, texture and altitude was noted.

C:N ratio was higher in MRF than the other forests in both seasons while in DMEF it was high only in the wet season. Lowest C:N ratio was recorded for the DMEF.

NO_3^- levels were low in the wet season and high in the dry season in all the three soils. In the dry season, DMEF had the highest NO_3^- content, while LRF had the lowest. The three soils showed higher NH_4^+ levels than NO_3^- levels indicating that nitrification and the numbers of nitrifiers were low in these soils. MRF and LRF soils had lower NH_4^+ contents than the DMEF.

Abundance of nitrifiers (ammonia oxidizers and nitrite oxidizers) correlated with the NH_4^+ level of the soils. MRF and LRF soils had low numbers of nitrifiers than DMEF soil. The number of nitrifiers also correlated with soil pH, Soil temperature and with the other available PO_4^- content.

The nitrification rates which showed correlation with the number of nitrifiers were however low in MRF and LRF soils than in DMEF soil.

Nitrogen mineralization rate was high in the dry season and overall DMEF soil showed the highest rate of nitrogen mineralization.

Fairly large population of denitrifiers were recorded in all the three soils.

Decreasing viable bacterial counts, fungal colony forming units and microbial biomass with increasing rainfall were recorded for MRF and LRF soils. But DMEF soil showed increasing bacterial, fungal cell numbers and also microbial biomass with increasing rainfall. Fungal colony forming units and bacterial counts in LRF were lower than that of other two forests.

Similar to the microbial biomass changes in DMEF during the dry and the wet seasons, CO_2 evolution rates also increased with rainfall. A burst of CO_2 evolution was recorded in DMEF soil when the soil sample were incubated with moisture adjusment during the dry season. Other two forests did not show high variations during the wet and dry seasons.