



CHAPTER V

CONCLUSIONS



- The present study shows that three types of land cover have a significant impact on physical, chemical and biological properties of soils. Among various soil physical properties (soil pH, particle size distributions and bulk density) examined at different depths under three types of land cover (teak, bamboo and mixed), only the soil pH was not significantly different between types of land cover and at different depths.
- The type of vegetal cover has a significant impact on SOC up to a depth of 125 cm and also alters the quantity of SOC in the soils. SOC content in these soils with three types of land cover was sufficiently large indicating their sink capacity. SOC content in soils with teak land cover was significantly large as compared to bamboo and mixed land cover showing its ability to sequester more amount of carbon in soils. Bamboo showed the highest content of carbon (up to 25 cm) which is attributed to its shallow root system with prolific growth. Soils with higher microbial activity (mixed land cover) showed a larger fall in the ratios of SOC between 100-125 cm and 0-25 cm. SOC stock with a depth interval of 25 cm showed how SOC movement across the soil system gets differed due to vegetal cover. A steep fall in the SOC content was observed up to ~50cm and at subsequent depths the decrease was much lesser. This is an indication of higher biological activity associated with top layers reflecting greater degradability of SOC at these depths.
- Results of physical fractionation of SOC showed that the movement of SOC is unidirectional towards recalcitrant pools. The movement is dependent on type and quality of leaf litter. The proportions of pools 1 and 2 remained the same across the profile. There was a decrease in SOC at deeper layers, but the proportion of the recalcitrant pool remained almost the same.
- Uniformity was seen in the decomposition of the three types of litter by the end of 320 days at all the depths irrespective of initial differences. Quantity of litter decomposed in the litter bags of teak and bamboo kept at

the exchanged sites (teak litter bags in the soils covered by Bamboo and *vice versa*) confirms that the microbial population is more generic by being responsive to compounds present in foliage for decomposition and not specific to plant/tree species. Soil respiration values support the conclusion that rates of decomposition observed in these soils are higher.

- Increases seen in SOC of soils coming from the litter bag experiment show that tropical soils do have additional absorptive capacity for organic carbon. The limitation is only with the input and not with their sink potential. Changes in SOC content at deeper levels (25 and 50 cm) revealed another dimension in decomposition activity. The newer inputs are relatively less than the base levels of SOC contents of previous years present in these layers. The proportion of decomposition is maximum for fresh inputs in litter bag compared to the small variations seen in the already existing SOC. This shows that microbes process SOC as per the law of diminishing returns. Availability of fresh SOC (in the litter bags) activates microbes and processing / decomposing of fresh litter becomes faster. Once SOC reaches or becomes 'chemically stable' with compounds equivalent to the type present in these soil layers, the microbial activity becomes very low as the microbes do not get any further energy by the breakdown. The rate of decomposition and subsequent change/s seen in SOC of these soils indicated that additional inputs (though the quantity in the bags was small) can be easily taken in. Hence soils at the study area are act as a sink for carbon rather than a source while adding fresh inputs into soils.
- Uniformity seen in chemical composition of SOC coming from proton NMR study reveals that barring initial steps, decomposition of organic matter would follow more or less the same path in tropical soils, irrespective of differences in plant litter.
- The increasing HF-soluble carbon concentrations from surface to deeper layers of soils under three types of land cover clearly indicates that deeper

layer contains old/stabilized carbon. The increase of HF-soluble carbon in the soil samples coming from litter decomposition experiment indicating that the stabilized and/or old carbon associated with minerals are not depleted by microbes even after adding the fresh inputs into the soils at three different depths.

- Stable isotopes study revealed enrichment across the vegetal covers. pMC values showed that the study area is under a predominantly C₃ vegetation and switch over of vegetal cover (C₃ to C₄ or *vice versa*) had not occurred in the past 2200 years.