SOIL CARBON SEQUESTRATION IN *EUCALYPTUS GRANDIS* FOREST PLANTATIONS OF SRI LANKA ALONG A CHRONOSEQUENCE OF FOREST AGE

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Managing forest plantations to sequester atmospheric carbon in soil has drawn the scientific attention as a way of reducing global warming and improving soil quality. In Sri Lanka, the area of forest plantations has substantially increased over the past few decades and, more than 20% of these are represented by *Eucalyptus* species. However, carbon sequestration in Sri Lankan *Eucalyptus* forest plantations, especially focussing on soil, has not been fully understood. Therefore, soil carbon sequestration potential of *Eucalyptus grandis* W. Hill, forest plantations in the intermediate zone of Sri Lanka was studied over a chronosequence of age (4, 10, 19 and 27 years after establishment) and compared with patana grassland (the land use before afforestation), a natural tropical evergreen forest and a tea (*Camellia sinensis*) plantation in the same zone. The factors that affect soil carbon sequestration were also examined. Six 20 m x 20 m experimental plots were established in each land use. Above ground parameters such as tree heights, Diameter at Breast Height (DBH), crown width, tree density and diversity of understory were recorded. Litter dry mass and major litter nutrients were measured. Soil samples were collected at two depth levels (0-15 cm and 15-30 cm). Total Organic Carbon (TOC), Microbial Biomass Carbon (MBC), Permanganate Oxidizable Carbon (OC) and Water Soluble Carbon (WSC) were measured. Moisture content (SMC), texture, bulk density, pH, α-pinene concentration, major soil nutrients, fungi: bacteria ratio and microbial biomass nitrogen content in soil were also determined. The data were analysed via the mixed modelling approach to eliminate pseudo-replication in the experimental design. Above ground and below ground carbon stocks were calculated. The results indicated that total height, DBH and crown width of *E. grandis* trees increased significantly with stand age while tree density had decreased due to thinning practices operated under the clear cutting silvicultural system. Although there was no statistical significance, the aboveground carbon stocks showed tendency to increase with stand age. Therefore, overstory contribution for carbon sequestration apparently increased with stand age. The understory vegetation density and diversity showed negative relationship with stand age exhibiting a decline in understory's contribution for carbon sequestration with increasing stand age. The declining trend in nutrient levels of litter after crown closure also could influence slow mineralization of litter leading to increased carbon sequestration in soil. Soil moisture content (SMC), soil acidity and α- pinene concentration in soil increased significantly with stand age improving carbon sequestration potential of *E. grandis* plantation soil. Most of the soil nutrients displayed a declining trend up to a certain level. The stable carbon (SC) stock in 0-15 cm soil layer after 27 years of afforestation was 9.07 ± 2.21 t ha^{-1}, which was 36, 34 and 10 fold higher than those of patana grassland, natural forest and tea plantation, respectively. From these results, it could be concluded that the *E. grandis* plantations increase particularly stable soil carbon storage along a chronosequence of age. Therefore, in the perspective of carbon sequestration, the presence of *E. grandis* plantations is advantageous, especially when the trees get older.