ABSTRACT

The study assessed the soil organic carbon dynamics of selected multiple land use categories of Kottayam district from a climate change perspective. The study consists of a general baseline investigation of soil carbon dynamics of the area and four detailed case studies regarding the effect of land use, land use change and disturbances on soil organic carbon dynamics. As management options two microcosm experimental studies using earthworms and vetiver plant to mitigate soil carbon loss, emission reduction and to enhance soil carbon sequestration were also done. Analysis of various soil carbon dynamics indicators like soil organic carbon (SOC), particulate organic carbon (POC), potential carbon mineralization (PCM), microbial biomass carbon (MBC), different fractions like labile carbon (CL) and non-labile carbon (CNL), glomalin related soil protein, water stable aggregates (WSA), soil carbon turnover, soil carbon source and sink capacity, vulnerable C pool identification, carbon pool index calculation, quantification of soil based carbon dioxide emission and subsequent global warming potential (GWP) were done. The soil carbon was studied as per the standard methodology of IPCC, 2006.

From the study it was seen that the regional level soil organic carbon studies have greater importance because of the high spatial variability of soil carbon. The soil type and land use have greater role in determining soil carbon dynamics of the area. Each soil type has an optimal land use pattern which is sustainable from the point of global warming and climate change. During the study the soil specific land use types were identified and suggested. The impacts of land use and soil based disturbance on the soil carbon dynamics of forest ecosystem and grassland were found to be detrimental. It was found that the emergence of monoculture plantations has severely impacted the soil C transition of the region. The regional contributions towards global carbon emission and the global warming potential of the area were identified. From the study it was revealed that the set parameters are optimal indicators capable of addressing soil carbon dynamics. The study also showed the potential of earthworm and vetiver plant as biological tools in soil C sequestration and management.

Key words: Soil organic carbon dynamics, carbon sequestration, land use change, climate change, global warming potential, emission reduction.