Ecological Assessment of Carbon Sequestration and Partitioning in Regenerating Fallow Systems

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Abstract

Ecological field surveys have been used to assess carbon sequestration of regenerating vegetation of different ages. The regenerating vegetation categories were sampled using the direct field-plot harvest technique and the percentage carbon contents of the associated soils were determined by the wet digestion method. Results showed that fallow vegetation provided a significant carbon sink. The carbon stocks of vegetation and the underlying solum increased with advancement in age of the vegetation. The approximate relative percentages were 11% (in less than 3 years old fallows), 18% (in 3-6 years old fallows), 23% (in 6-8 years old fallows) and 48% (in open canopy secondary forests). The woody trees were more efficient repositories of elemental carbon than any other physiognomic stratum; they hold nearly 49% of the total carbon. The study confirms earlier observations of some experts that a large proportion of the carbon in most tropical ecosystems are held tenaciously in the woody biomass of trees, and that in regenerating vegetation systems carbon sequestration improved with advancement in the age of the fallow cycle.

Introduction

Current trends, spatial magnitude and pace of human-induced land-cover transformations have been worrisome because of the significant ecological implications for ecosystems functioning and global climate change. A more subtle consequence of rapid land cover alterations, that is potentially a significant factor in global climate change, but least acknowledged, is changes in carbon storage by biospheric ecosystems (Warrick & Farmer, 1990; Roberts, 1994).

The linkage between global climate change and atmospheric carbon dioxide (CO_2) loading is not in doubt at all. What is uncertain, however, is the exact relationship between the two (International Geosphere-Biosphere Programme, 1990). While there is much controversy over the exact figures and the spatial and temporal variations, it is estimated that the atmospheric CO_2 loading has increased by about 25% from its pre-industrial level and is rising at approximately 0.4-0.5% per annum (Houghton & Skole, 1990).

The exact effect of this and future increases are not known, yet predictions abound of an atmospheric carbon loading that will be double that of pre-industrial times by the year 2030, with rise in mean global temperature of between 1 and 3 °C. The consequential effects of this may be dramatic and range from significant rises in sea level to increased frequency and intensity of extreme climatic phenomena (Carter *et al.*, 1991; Henderson-Sellers, 1994; Rosenzweig & Parry, 1994).

The necessity to quantify more accurately activity of terrestrial vegetation was underscored by attempts in the late 1970s to calculate a global carbon budget. Although the empirical results from the Mauna Loa