THE POTENTIAL OF AFROMONTANE RAIN FORESTS TO MITIGATE CARBON EMISSIONS IN TANZANIA

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ABSTRACT

One of the major ways of mitigating carbon emissions is by emission avoidance or conserving existing carbon (C) pools on the land through slowing deforestation or improved forest harvesting practices. Field measures of tree dimensions and chemical soil analysis for organic carbon were used to quantify the carbon (C) storage potential of three tropical montane rain forest ecosystems; one on the slopes of Mount Kilimanjaro and two (Usambara and Uluguru) in the Eastern Arc Mountains of Tanzania. The above ground and root carbon of trees ranged from 295±8 to 517 ± 17 t h^{-1}. The tree carbon storage was lowest in the Kilimanjaro forest (295±8 (SD) t h^{-1}), and highest in the Usambara forest (517 ± 17 (SD) t h^{-1}. The C storage in the Ulugurus was 388± 10 (SD) t h^{-1}. The soil carbon storage (1423.7 t h^{-1}) in Kilimanjaro was significantly higher than that in tree biomass. On the other hand the soil carbon (418 ± 100 and 295 ± 53 t h^{-1}) in the Usambara and Uluguru respectively) was significantly lower than the biomass carbon in both forests in the Eastern Arc forests. The potential of these ecosystems to act as carbon sink and mitigate greenhouse gas emissions is evident. This capacity for carbon storage, population pressure and the extensiveness of these forests in the region makes their conservation of global significance for carbon emission mitigation.

Key words: Montane rain forest, carbon storage, emission mitigation, carbon pool.

INTRODUCTION

At the 1992 Rio conference on environment and sustainable development a non-legally binding statement of principles was adopted for the management, conservation and sustainable development of multiple use forests. The statement documents the importance of incorporating environmental costs and benefits into market mechanism to achieve the dual benefit of forest conservation and sustainable development both domestically and sustainably. The efforts to develop climate action plans within countries that have signed or are about to sign the International Framework Convention on Climate Change have caused a great attention to the value of improving trees and forests as one of the potential mitigation strategies.

Land use, Land use Changes and Forestry (LULUCF) activities have historically been and are currently net sources of carbon (as carbon dioxide) to the atmosphere (Brown *et al.*, 1996; Sampson, 1993). On the other hand there is a potential for LULUCF activities to mitigate carbon emissions. This may be achieved through emission avoidance or conserving existing carbon (C) pools on the land (e.g. slowing deforestation or improved forest harvesting practices) and carbon sequestration or expanding carbon storage in forest ecosystems by increasing the area and/or carbon density of forests (e.g. in plantations, agroforests, natural regeneration, soil management). Others include increasing storage in durable wood products and substituting sustainably grown wood for energy intensive and cement based products (e.g. biofuels, construction materials) (Dixon *et al.*, 1994b; Sampson, 1995; Winjum *et al.*, 1997; Dixon, 1996; Brown *et al.*, 1996; Brown, 1997; 1999; Munishi, 2001).

Understanding the role of terrestrial ecosystems in the global carbon (C) cycle has become increasingly important as policy makers consider options to address the issues associated with