Abstract

This study determined the trend in carbon densities and stocks from major land uses/covers of semi arid and sub humid areas of Uganda. Carbon densities were estimated from soils and woody biomass pools of the major homogenous units in terms of land-use/cover, topography and soil. In Soroti, preliminary results show that the carbon density was generally highest in soil than in above ground wood plants (P<0.05). The highest carbon density was observed under woodland (248.2Mg/ha) and fallow (213.1 mg/ha), followed by grazing land (173.2 mg/ha) and annuals (167.66 mg/ha); and the lowest was observed under perennial agriculture (Orchard) (56.6 mg/ha) (P<0.05).

Key words: Agro-ecological zones, carbon densities, carbon stocks, land-use cover/change, Uganda

Résumé

Cette étude a déterminé la tendance dans les densités de carbone et ses stocks à partir des principales utilisations de terre/ couvertures végétales des régions semi-arides et sub-humides de l’Ouganda. Les densités de carbone ont été estimées à partir des sols et des ensembles boisées de biomasse des unités homogènes principales en termes d’utilisation de terre/ couverture végétale, topographie et sol. A Soroti, les résultats préliminaires prouvent que la densité de carbone était généralement la plus haute dans le sol que dans les arbres au-dessus du sol (P<0.05). On a observé la densité de carbone la plus élevée dans la région boisée (248.2Mg/ha) et la jachère (213.1 mg/ha), suivie de la prairie (173.2 mg/ha) et les plantes annuelles (167.66 mg/ha) On a enfin observé la plus basse densité sous l’agriculture prolongée (verger) (56.6 mg/ha) (P<0.05).

Mots clés: Zones agro-écologiques, densités de carbone, stocks de carbone, couverture d’utilisation du terre/changement, Ouganda
Background

Carbon emissions from human activities have contributed significantly in upsetting the natural balance and depletion of carbon (C) storage in terrestrial ecosystem (Bhadwal and Singh, 2002). In the tropics, land use/cover change has also aggravated the situation in attenuating the effects of local wind patterns. It has been observed that the current rate of deforestation in the tropics exceeds secondary forest regrowth and C sequestration (Kauffman et al., 2009). Changing land-use strategies that maintain standing forests are recognized as among the least expensive of climate change mitigation options (Virgilio and Marshall, 2009). Further, secondary tropical forests have been suggested to have great value for their potential to sequester atmospheric C (Lugo and Brown, 1992). These options require an understanding of and capability to quantify C dynamics at landscape scales. Because of the diversity of physical and biotic features of tropical forests as well as approaches and intensities of land uses within the tropics, there are tremendous differences in the capacity of different landscapes, and agro-ecological zones to store and sequester C (Bhadwal and Singh, 2002). Major gaps in our current knowledge include quantification of C pools, rates and patterns of carbon loss following land-cover change, and quantification of the C storage potential of secondary forests following abandonment (Kauffman et al., 2009).

Literature Summary

Global climate is being affected by human activities through altering the natural balance of certain greenhouse gases (GHG) into the atmosphere. Carbon dioxide (CO₂) is one of the GHG that contributes considerably to global warming (IPCC, 1995). One possible strategy to reduce GHGs with great potential is to use forest to sequester CO₂ (Prentice et al., 2000). On the other hand, the possibility of expanding carbon storage in forests has been identified as a potential measure to mitigate climate change (DeFries et al., 2000; FAO, 2001). Recent studies in Uganda have demonstrated that some other land use/cover, such grassland could play a significant role in C sequestration (Majaliwa et al., 2010). The dynamics of carbon that is present in a certain land use systems over its life span can be reflected with time-averaged carbon stocks. Different percentages of forest cover store different amounts of carbon and the changes in forest cover, as expressed in a greenness factor to effectively surrogate biomass, are used in the model to calculate the annual changes of carbon (Houghton and Hackler, 2000; Myneni et al., 2001; Song and Woodcock, 2003).
Study Description
This study was conducted in Soroti and Rakai districts situated in the cattle corridor. Homogenous units in terms of soil, land-use/cover and topography were identified using SWAT software. In each homogenous unit, soil carbon and above ground woody carbon was estimated in four replications of each homogenous unit (Hairiah et al., 2001). Soil samples were obtained from two soil depths: 0-15 and 15-30 cm. The carbon stock was estimated as a sum of soil and above ground carbon stocks (Woomer and Palm, 1998).

Preliminary Results
Figures 1 and 2 present the soil contribution to carbon density and carbon density of different land-use/covers in two parishes of Soroti district. Soil contribution was observed highest in

![Figure 1](image1.png)

**Figure 1.** Contribution of 0-30 cm soil depth to carbon density in Soroti and Gweri sub counties, Soroti district.

![Figure 2](image2.png)

**Figure 2.** Carbon density of the major land-use/cover in Soroti and Gweri sub counties, Soroti district.
grazing land (90.1%), followed by settlement (77.4%), fallow (67.7%) and by annuals (64.0%), the lowest soil contribution was seen in woodlot (30%) (P < 0.05). The highest carbon density was observed under woodlot with (248.17Mg/ha), fallow (213.1Mg/ha), grazing land (173.2 Mg/ha) annual (167.7Mg/ha); and the lowest was observed under Perennial (Orchard) (56.55 Mg/ha) (P≤0.05).

The findings suggests that this information is very useful in designing adaptation and mitigation strategies to climate change and variability. Based on the results of this study, and interaction with the study communities, it is recommended that:

- There is need to create awareness on climate change and variability effects on peoples’ livelihoods to the whole range of stakeholders including farmers, extension workers and policy makers.
- Farmers should be advised to utilize the local materials to enhance their carbon stock for improving soil fertility and water and conservation.

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