

Effects of Land -Use Change through Logging Disturbance on the Linkages between Plant Diversity, Carbon Storage and Soil Characteristics in Bia Conservation Area in Southwest Ghana

Asitoakor, Kwesi Bismark

2011

ABSTRACT

Land-use changes due to natural and anthropogenic activities such as logging disturbances have tremendous effects on plant diversity, carbon sequestration and edaphic factors. However, forest logging in tropical forest or regions is a significant part of revenue generation and job creation. Understanding the impacts of logging disturbances is very important for conservation and climate change mitigation. The present study was conducted to investigate the effects of land-use change through logging disturbances on the linkages between plant diversity, carbon storage and soil characteristics. Plant diversity was enumerated using plot (25 m x 25 m, 5 m x 5 m and 1 m x 1 m) sampling methodology; tree biomass determined from allometric equations; soil organic carbon and plant litter carbon were determined using Walkley-Black method; and soil characteristics were estimated using standard laboratory methods. Plant diversity was estimated using Shannon Wiener and Simpson diversity indices. The results of the study indicated that land-use change through logging disturbance affects species diversity and composition although the effects on plant dominance, density and carbon stocks were insignificant. Total mean carbon stock ranged from 340.6 ± 51.1 Mg C/ha in post-logged forest, 230.2 ± 72.3 Mg C/ha in un logged forests to 299.9 ± 83.5 Mg C/ha in swamp forests but was not significantly different between the land-use types ($p > 0.05$). The contribution of carbon by various ecological guild species was such that Non-Pioneer Light Demander in un logged forest contributed the highest of 100.2 ± 29.9 Mg C/ha. Pioneers in post-logged forest contributed 149.1 ± 39.3 Mg C/ha and Shade-bearers contributed 132.3 ± 49 Mg C/ha in

swamp forests. Land-use change did not significantly influence the surface soil (0-30 cm depth) except for its organic carbon. Soil parameters (nitrogen, phosphorus and potassium) were significantly different in the three land-use types. Large trees dominance showed strong positive correlation with the total carbon stocks, total above-ground carbon stocks and the total soil organic carbon (SOC). The findings of the study also showed that tree functional traits were better predictors of carbon stocks in the Bia Conservation Area than the tree species diversity. Future research works on carbon content in logged and exported timbers, successional inventory of species carbon composition and accumulation for both BCA and other forest reserves in other regions are recommended as these are important in planning and management decisions to enhance sustainable utilization, biodiversity conservation and the mitigation of global climate change.

Supervisors

Dr. Asase Alex

Dr. Ofori- Frimpong, Kwasi

