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Land Use Change Effects on Ecosystem Services and Opportunities to Enhance Food Security in Central Highlands of Ethiopia

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Abstract

In Ethiopia, land resources scarcity coupled with high population growth influences land use decisions that cause conflicts with neighbouring nature conservation areas. For small holder farmers, what to eat and use from the ecosystem determines the pattern of land use changes. However, this practice failed to satisfy the food self-sufficiency and impedes sustainable land management.

This research investigated land use change effects on ecosystem service (carbon stock) and biodiversity. In addition it assessed viable options to enhance food security while maintaining ecological integrity. Carbon stock and woody plant species diversity were compared across five land use types (natural forest, plantation forest, moderately cultivated land, intensively cultivated land and grassland) in the Menagesha Suba forest area. Nested plot design of 50m × 50 m for trees with diameter at breast height (DBH) >50 cm, 25m × 25 m for trees with DBH between 5 and 50 cm and 1 m × 1 m for seedlings and saplings were used. Likewise 0.5 m × 0.5 m plots were used in four corners of 1 m² subplots for litter and soil samples collection.

The preliminary results show higher woody plant diversity for both natural forest and moderately cultivated land compared to the plantation forest and the other agricultural lands, clearly showing woody plant species diversity was highly influenced by land management. Above ground biomass carbon stock also varied across land uses. It is higher for the forests and lower for the agricultural lands. Similarly, soil carbon content significantly declined on agricultural lands compared with the forest lands. The result indicates that clearing land for agricultural purposes negatively influenced the important supporting ecosystem services of biodiversity and carbon stock, which both play a pivotal role in function of ecosystems. This shows that forest clearing for intensive agriculture misses the opportunity to contribute to sustainable food security integrated with the maintenance of ecosystem services. In this regard, mosaic agriculture landscapes incorporating agroforestry and carbon financing have recently received much interest as a cost effective alternative to enhance food security and sustainable land management. The practice of agroforestry is already in place in the study area and profitable although it needs further up scaling.

Keywords: Agroforestry, biodiversity, carbon financing, carbon stock, food security, land use change