**Tropentag, September 19-21, 2012, Göttingen - Kassel/Witzenhausen**

"Resilience of agricultural systems against crises"

# Effects of Management Practices on Carbon Allocation in the Semi-Arid Savannahs of the Borana Region, Ethiopia

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**Abstract**

Grassland systems cover 3.9 billion ha, 25 % of the earth´s terrestrial area, and could, according to FAO (2009), sequester up to 2 GT $CO_2$ equivalents worldwide if appropriate management of vegetation and soil resources would be applied. Carbon is stored in different pools: dead and alive biomass like plant roots in the soil, and living biomass (grasses, shrubs and trees) and litter aboveground.

Livestock production has been a major source of income generation and food security in the semi-arid savannahs of the Borana region, Ethiopia, ever since. The dependency on traditional livestock-based pastoral and agro-pastoral livelihoods under ecological and economic pressures (droughts, population growth, overgrazing, etc.) is no longer sufficient to sustain food security. To overcome vulnerability of these communities, diversification of income is of crucial importance. Payment for environmental services (PES) based on reduction of carbon emissions and carbon allocation linked to livestock production could be one tool to diversify income of the vulnerable group of Borana pastoralists. Range and herd management may have exceptional impacts on carbon fluxes in the grass- and bush-land savannahs of southern Ethiopia.

Four vegetation types; namely grassland, tree savannah, bush land and tree-grass-bush savannah, have been distinguished in the research area. The pastoralists differentiate between year-round and seasonal grazing by installing "enclosures". Seasonal grazing patterns were found in grass and tree savannah. Therefore, five 900 $m^2$ plots each were located in year-round grazed and seasonally-used grass and tree land. Soil samples were taken in four different depths up to 100 cm to analyse for total carbon, soil organic matter and soil organic carbon content as well as to examine bulk density, pH and texture of the soil. Aboveground biomass was harvested and tree biomass was calculated by using allometric equations. A regression analysis was run to portray changes in organic carbon pools and allocation across vegetation type, management practice and soil depth.

The results will help to evaluate the impact of management practices on carbon fluxes in the soil and on aboveground biomass production. Carbon allocation processes will be better understood and information can be used to improve these grazing systems towards higher sustainability and crisis resilience.

**Keywords:** Carbon allocation, enclosure, grazing, savannah, vegetation type

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