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MSc. Thesis

**„Effects of Management Practices on Carbon Allocation
in the Semi-arid Savannahs of the Borana Region,
Ethiopia“**

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Abstract

In the semi-arid savannahs of the Borana region in southern Ethiopia, the majority of people lives semi-sedentary and depends on their livestock, mainly cattle, goats and camels, for income generation. Traditional grazing systems are endangered and have been partly destroyed by rapid population growth, structural changes, governmental intervention and extreme weather events. Livestock-based pastoral and agro-pastoral livelihoods are no longer sufficient to sustain food security and living standards under these circumstances.

With climate change being one of the most important topics in the 21st century, reducing CO₂ in our atmosphere has become a primary goal of international efforts.

One idea to overcome the poverty and vulnerability of the pastoralist communities in southern Ethiopia is to establish a system of payment for environmental services (PES) based on the reduction of carbon emissions and the carbon sequestration potential of semi-arid savannahs linked to different rangeland management practices.

The aim of this study was to assess the impact of seasonal grazing, in so called enclosures, areas that are only grazed during the dry period, and continuous grazing on above- and belowground carbon allocation. Aboveground biomass production and carbon stocks, belowground carbon stocks, soil parameters such as bulk density and carbonate content, species composition and habitus and stocking rate and carrying capacity were examined in 20 plots in a 10X10 km² area; five plots each for the respective management and vegetation type. The following types were distinguished in the area: Enclosures in grassland, enclosures in tree savannahs, year-round grazed grassland, and year-round grazed tree savannah. An analysis of variance (ANOVA) was used to describe differences in above- and belowground carbon allocation depending on vegetation and management type. It was shown, that all parameters, except for the total aboveground biomass production and the organic carbon allocation over depth were significantly influenced by the management type. Belowground carbon stocks were higher under continuous grazing, while seasonal aboveground biomass accumulation was highest in enclosures. Palatability of species and soil cover was significantly better in enclosures than in continuously-grazed areas. Species composition and habitus changed to more dicot and annual species with increasing grazing intensity.

The results on the variability of carbon stocks under different management practices help to develop a sustainable rangeland management system in this region and give some indication on the carbon sequestration potential.

Key words: Carbon allocation, Enclosure, Vegetation Types, continuously-grazed areas, Savannah, Species composition