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Deforestation and land use strongly effect soil organic carbon and nitrogen stock in Northwest Ethiopia

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Soil is the largest terrestrial organic carbon pool and can act as a source or sink for atmospheric CO_2. Although reliable soil carbon (SOC) stock measurements of major ecosystems are essential for predicting the influence of advancing climate change, comprehensive data on SOC stocks is still scarce for most ecosystems in subtropical areas. In this study SOC and N stocks of different land use systems were investigated along a climatic gradient in Northwest Ethiopia. The land use systems ranged from dry subtropical Afromontane forest, as the baseline, to cropland as the most degraded system. In addition we investigated the changes of SOC stocks after interventions to recover vegetation cover, these were eucalyptus plantations and an exclosure to prevent grazing. Total SOC varied between land use systems and ranged from 3.1 kg C m-2 in croplands to 23.9 kg C m-2 in natural forest, and average N stock ranged from 0.4 kg N m-2 in croplands to 2.1 kg N m-2 in natural forest. In forests, there were a clear vertical gradient in SOC and N stock down the soil profile, and 60% of the total SOC and N stocks were found in the upper 10 cm soil depth. Using the Sr/Ca and Ba/Ca ratios and the vertical distribution of the C/N ratio of the soil, the losses of SOC were shown to be due to loss of the of the upper soil layer. Afforestation of degraded croplands and grazing lands with eucalyptus increased SOC stocks to nearly 70% of the natural forest levels with 30 years. Exclosure, which removed grazing pressure and allowed regeneration of native vegetation, increased SOC in the top soil only.