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Impacts of traditional land use practices on soil organic carbon and nitrogen pools of mountain ecosystems in Nepal

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Crop production, animal husbandry and forestry are three closely interlinked components of land use systems in the mountains of Nepal. Forests are the major source of fuel wood, construction materials, fodder and litter. The latter is used as a bedding material for livestock and forms an important component of farmyard manure. In addition forest grazing by cattle is a common practice. Excessive extraction of biomass from the forest leads to a decline of soil organic matter and nutrient contents. On the landscape scale these negative effects will partly be compensated by positive effects on soil organic matter and nutrient stocks of arable soils. The experimental data base for a quantification of such effects at the scale of communities is however poor, in particular for Nepal. Understanding the impact of subsistence farming on ecosystems is imperative in order to recommend successful and sustainable land management practices. The aim of our study is to quantify effects of land use on carbon and nitrogen pools and fluxes for mountain communities in Nepal. Results of a case study in the buffer zone area of the Sagarmatha National Park are presented. The potential vegetation comprises mixed forests of Quercus semicarpifolia, Rhododendron arboreum and Tsuga dumosa. Carbon and nitrogen stocks in soil and vegetation were quantified for three different land use types, namely: forest with low human impact, forests with high human impact and agricultural land. The scale of disturbance of the forests has been classified by visual estimation considering the percentage of litter raked, number of lopped trees, and grazing intensity assessed by signs of trampling and the number of trails. After stratification of the community area, 20 plots of 10 m radius were established (17 forest plots, 3 plots for arable land) where biometric data of the vegetation were determined and sub-samples were taken for chemical analyses. Organic layers (litter remaining after litter raking) and soil samples were collected (volumetric sampling of geometric horizons down to 1 m depth). Fluxes of carbon and nitrogen from the forests were accounted by combining results of sub samples of biomass extracted by local people during the field survey and information on amounts and source areas provided by the farmers. Also the amount of carbon and nutrients applied with farmyard manure and the extraction by harvest was determined for the arable land. First estimates of carbon and nitrogen cycling at the community level and on impacts on soil status will be presented.