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Compound-specific Stable-isotope Analysis to Trace Carbon Sink-and-Source Relationships between Areas of Critical Land Degradation and Deposition Areas in the Chieng Khoi Catchment

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Abstract

Innovative technical and progressive approaches are strongly required to adequately trace soil organic carbon (SOC) sink-and-source relationships between areas of critical land degradation and deposition areas. This is in particular crucial for many fragile mountainous landscapes of South East Asia in which cropping systems have encountered a radical change in the recent past due to enhanced agricultural commercialisation as well as a growing population and migration processes. Consequently, this agricultural intensification in upland areas is leading to rampant water erosion promoting severe losses of SOC which has been acknowledged as central determinant of soil productivity. It is therefore of central importance to study such sink-and-source relationships between areas of critical land degradation and also deposition areas in the lowlands.

The application of stable isotopes (*i.e.* stable ^{13}C) has been proved to be very useful in investigating SOC dynamics in cultivated soil ecosystems. In the present study, we introduce a compound-specific stable-isotope (CSSI) approach which is currently under development at the Department of Plant Production and Agroecology in the Tropics and Subtropics of the Hohenheim University to investigate source-and-sink relationships of SOC in the Chieng Khoi catchment, Son La Province, Viet Nam. By applying the CSSI approach, we use natural abundance signatures of plant-specific organic compounds (*e.g.*, $\delta^{13}C$ values in fatty acids and lignins) originating in upland soils in the studied tropical catchment including a range of different crops (*e.g.* maize, cassava), as well as natural and secondary forests. These CSSI-biomarkers will be then traced in the lowland soils (*i.e.* paddy rice soils) to estimate the dynamics of landscape SOC stocks at catchment level and to assess how land use intensification has changed the spatial and temporal distribution of the respective C from uplands to lowlands.

Keywords: ^{13}C, Chieng Khoi catchment, stable-isotope analysis, erosion, source-and-sink relationship, soil organic carbon, Viet Nam

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