Geophysical Research Abstracts,
Vol. 10, EGU2008-A-02806, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-02806
EGU General Assembly 2008

Historic land use affects composition of soil organic matter in adjacent forests and grassland soils

C. W. Mueller , I. Koegel-Knabner

Lehrstuhl für Bodenkunde, TU-Muenchen Department fuer Oekologie und Oekosystemmanagement, Germany, Freising-Weihenstephan

(carsten.mueller@wzw.tum.de / Fax: +49 (0)8161-71 4466 / Phone: +49 (0)8161-71 3679)

Changing management practices and alternating vegetation have major influences on soils. There is considerable concern about land use changes inducing alterations of the soil carbon cycle, having therefore a remarkable influence on soil carbon sequestration. To unravel changes of soil organic matter (SOM) characteristics induced by alterations in land use, we studied three adjacent sites with similar pedogenic properties (soil type (Leptic Cambisol), texture, clay mineralogy). The study area is located in eastern Germany in the Saxon Ore-Mountains 25 km south of the city of Dresden. We investigated a (i) soil under continuous Norway spruce forest, a (ii) former cropland soil afforested 77 years ago and a (iii) grassland soil deforested 54 years ago. For standard soil properties (as pH, cation exchange capacity (CEC), C and N stocks) we sampled the A and B horizons of 9 soil pits per site to obtain statistical significant data sets. To unravel differences of SOM characteristics between the sites we used a combination of physical fractionation, ^{13}C-CPMAS NMR spectroscopy and radiocarbon analysis of bulk soils and SOM fractions. We obtained free particulate OM (POM) and occluded POM (within soil aggregates) via density fractionation and sand, silt and clay associated OM via subsequent particle size fractionation.

Soil properties as pH, CEC and base saturation (BS) changed significantly with altered management, leading to higher pH and BS with concomitant lower CEC values at the grassland site. Higher total C stocks under forest were closely linked to the abundance of organic horizons in contrast to the absence of organic horizons on grass-

land. We observed an increase of the proportion of mineral bound C from the forests to the grassland, whereas more C was situated in free POM fractions under forest. High alkyl-C / O/N-alkyl-C ratios of free POM fractions indicated higher decomposition stages under forest (1.16) in relation to former cropland (0.48) and grassland (0.33). Historical burning on the former cropland and grassland led especially in the subsoils to considerable amounts of black carbon within soil aggregates which were positively correlated with higher radiocarbon ages of SOM. We show that historic management, such as burning and char production is still identifiable in the subsoils by the composition and ^{14}C activity of certain SOM fractions on a centennial scale. On a decadal scale, distinctive differences of mass contents, C distribution and decomposition stages within and between SOM fractions are visible for the altered former cropland and grassland compared to the continuous forest.