Geophysical Research Abstracts
Vol. 12, EGU2010-8667, 2010
EGU General Assembly 2010
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Humus form development of former arable soils under forest and fallow systems

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Soil humus is a multi-component organic media and most dynamic part of soil, even humus amount itself under natural vegetation is relatively stable and predetermined by climatic conditions and landscape. Soil cultivation including common farming practices – mechanical soil tillage, use of mineral fertilizers (especially nitrogen) and ameliorants aimed to increase crop production. Agricultural soils beside many environmentally unfavorable more or less controlled processes of soil degradation (nutrient leaching, soil erosion) have unstable level and quality of soil humus (qualitative composition). These humus fluctuations are controlled through organic matter development processes - accelerating or inhabitation of mineralization and humification.
During last decades economical drivers in Lithuania stimulated land uses changes (LUC) in less-favored farming areas with regions attributing to large proportions of low fertile soils, hilly landscape and ecological vulnerability. Prevailed types of LUC - arable land to grassland, land afforestration or land abandonment prompt agro ecosystems to return to land primeval state (under natural vegetation) and initial humus level through self-regulation. But listed transformations having own process drivers and prevailing soil humus development directions.
Experimental field at the Voke branch of LIA was established (in 1995) and studies conducted with the aim to monitor soil properties transformation, to explore variation of soil quality under different stages of renaturalisation. The experiment was designed with four sites (treatments) on former arable land: 1) left as a cropland site (control) (I); 2) transformed to grassland (II); 3) uncultivated or transformed to fallow (III) and 4) pine afforested site (IV). Assuming 10 years of experimental results (1995-2004) it was concluded that transition of agricultural land characterized as complex of factors having strong effect on energy and nutrients turnover, however soil testing data conclude that various LUC treatments had quite negligible differences in soil organic matter and their mineralization parameters (C/N ratio). Latest stage of experimental studies on this site concentrated on humus composition investigations, with the aim to examine humus form development on the second decade after land use changes. Observations are illustrating direction of mineralization and humification processes as proportions between humic (HA) and fulvic (FA) acids changing. The most intensive accumulation of total humic acids (0.32 % THA) found on grassland plot, compare to arable land - 0.21% THA. TFA found highly depended on soil fertilization (fertilized soils had significantly higher values), highest TFA concentrations observed on fallowing (0.46) and afforested (0.48) plots. Regression matrix of measured properties suggests that TOC concentrations respond mainly to HA1 fraction (r=0.97). Close correlation was found between TOC and FA2 (0.68) and HR3 (0.86) fractions. These were largely responsible for strong TOC correlations with sum of humic acids (THA) (r=0.72) and sum of fulvic acids (TFA) (r=0.75). However, there was no consistent relation of measured sum of HA and FA (THFA) from arable soil layer and TOC concentration (r=0.20).