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Soil cover patterns and dynamics impact on GHG fluxes in RF native and man-changed ecosystems

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The increased soil spatial-temporal variability is mutual feature for most mature natural and particularly man-changed terrestrial ecosystems in Central and Far-East regions of Russia with soil cover strongly pronounced bioclimatic zoning and landscape-geomorphologic differentiation. Soil cover patterns (SCP) detailed morpho-genetic analysis and typification is useful tool for soil forming and degradation processes quantitative evaluation, land ecological state and functional quality quantitative assessment. Quantitative analysis and functional-ecological interpretation of representative SCP spatial variability is especially important for environmentally friendly and demand-driven land-use planning and decision making.

The carried out 33-years region- and local-scale researches of the wide zonal-provincial set of representative ecosystems and SCP with different types and history of land-use (forest, meadow-steppe, agricultural and recreational ones) give us the interregional multi-factorial matrix of elementary soil cover patterns (ESCP) with different land-use practices and history, soil-geomorphologic features, environmental and microclimate conditions. Succession process-based analysis of modern evolution of man-changed and natural soils and ESCP essentially increases accuracy of quantitative assessments of dominant soil forming and degradation processes rate and potential, their influence on land and soil cover quality and ecosystem services. Their results allow developing the regional and landscape adapted versions of automated land evaluation systems and land-use DSS.

The validation and ranging of the limiting factors of ESCP regulation and develop¬ment, ecosystem principal services (with especial attention on greenhouse gases emissions, soil carbon dynamics and sequestration potential, biodiversity and productivity, hydrological regimes and geomorphologic stabilization), land functional qualities and agroecological state have been done for dominating and most dynamical components of ESCP regional-typological forms – with application of regional/local GIS, ESCP mapping, kriging, correlation tree models and adapted to region DSS.

Key-site monitoring results and regional generalized data showed 1-1.5 % Corg lost during last 50 years period, active processes of CO_2, CH4 and N2O emission (2-4-time variability in frame of one farm and of one vegetation season) and humus redistribution throw soil profile and soil cover patterns. Forest-steppe Chernozem ecosystems are usually characterized by more stable SCP than forest or steppe ones. The ratio between erosive and biological losses in humus supplies is estimated as fifty-fifty with strong spatial varia¬bility due to slope and land-use parameters. These problem agroecological situations can be essentially improved by climate-smart agriculture practice development with DSS-based landscape-adaptive land-use systems and organic farming stimulation with environmentally friendly technologies, adapted to conditions of concrete agrolandscapes in Central and Far-East Russia.