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ASSESSING THE CARBON STOCK AND ITS CHANGES FOR FORESTED ORGANIC SOILS IN HUNGARY

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ABSTRACT

Hungary committed to submit GHG inventory reports according to Kyoto Protocol under UNFCCC.

Our study – as a background research for GHG report – aimed at the assessment of total carbon stock in afforested organic soils in Hungary together with stock changes if possible. Additionally, we had to give assessments on the total area of forested organic soils, too. To fulfil the requirements we took the option to collect new data by appropriate field surveys and to evaluate historical data of earlier surveys.

However the basic reason for this study was the need to provide more precise data in GHG reports as it is required by improved GHG reporting protocol, having information on the actual carbon stock of our organic soils and their possible emission rates is crucial for developing appropriate land management plans for involved areas.

In order to identify organic soils we used the definition of Histosols according to WRB characterization of soils. Beside this we selected all the possible forest areas from the national forestry database based on site data records that reflected on organic soils by chance.

After we had the possible maximum area of forested organic soils we had to decide on sampling intensity. Using the soil data (both field survey and laboratory data) of an earlier survey (15 years ago) of a wetland area we determined the necessary sample size to have carbon content assessment within 95% confidence level. The 130 forest compartments for sampling were then chosen randomly while the size of the compartments served as weight for sample choice – the bigger the compartment the higher the chance to be chosen. Selected forests were subject of soil sampling. Undisturbed samples were collected from entire profiles according to systematic, regular depths and from respective soil layers. Soil-type and volumetric carbon content were determined for all the samples. Data was evaluated using statistical and GIS methods. Applying digital soil mapping tools we compiled map for occurrence of organic soils under forests in Hungary.

The assessments of carbon stock changes were based on the comparison of current results with the results of the 15-year earlier study.
Our results showed that the total area of forested organic soils in Hungary reaches 6500 ha ± 750 ha. Their average carbon content is 25.5% (m/m) ± 3%. The average thickness of histic horizon is 64 cm ± 12 cm. Total carbon content of these soils is app.: 4 x 10^6 tons ± 0.2 x 10^6 tons. The average specific carbon content of these soils is between 45 and 104 kg C*m^-2. This is equal with 455-1045 tC*ha^-1 carbon content. The amount of the calculated carbon stock change is app.: -2.27 tC*ha^-1*yr^-1 ± 0.34 tC*ha^-1*yr^-1. It means the change of organic horizon in an average of -1.30 cm*yr^-1 ± 0.17 cm*yr^-1. Supposing that the emission rate remains unchanged the total carbon stock can be emitted back to the atmosphere within 271 years.
CONFERENCE TOPIC: Digital soil mapping and proximal soil sensing

COMPILATION OF NATIONAL SOIL-TYPE MAP OF HUNGARY BY OBJECT-BASED, AND MULTI-LEVEL CLASSIFICATION METHODS

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ABSTRACT

Traditionally in Hungary the soil cover under agricultural and forestry management is typically characterized independently and just approximately identically. Soil data collection is carried out and the databases of soil features are managed irrespectively. As a consequence nationwide soil maps cannot be considered homogeneously predictive for soils of croplands and forest, planes and hilly/montounous regions. Therefore, despite of a great amount of available soil information from former mapping- and surveying campaigns, there are more and more frequently emerging discrepancies between the available and the expected data.

In order to compile a national soil type map with harmonized legend as well as with spatially relatively homogeneous predictivity and accuracy the authors unified their resources. Soil data originating from the two sources (agriculture and forestry) were cleaned and harmonized according to a common soil type classification.

The harmonised soil dataset consisting the data of almost 60 thousand soil profiles, describing 42 representative soil-types with spatial reference was divided into learning and test data point samples. Additionally, a corresponding dataset of 32 spatially exhaustive, ancillary, environmental variables – including legacy soil data, too – was established covering the whole area of the country.

In next step we applied methods, which have been used in image analysis so far. We synthesized a geo-referenced TIFF image consisting of the 32-predictor variables as image bands. It was loaded into eCognition Developer as synthetic image data. Sample data was added as thematic layer. A sequence of multi-resolution segmentations were applied on the “image layers” to delineate homogeneous spatial entities that were used later as objects for classifications. We applied different scales for segmentation in order to find the best result for the required spatial resolution. Altering segmentation scales corresponds to different map scales resulting in perfect topology of image objects allowing the reasonable aggregation and disaggregation of soil bodies. For base map we chose the L20 segmentation level corresponding approximately to a map
scale of 1:10 000, which performed higher object density in mountain areas and coarser in lowlands according to the spatial variation of the environmental variables. Image segments containing learning sample soil data points served as learning image objects to train image classifiers (Bayes, random tree, decision tree).

During classification we used the multi-level approach by that we mean a two staged classification process. First, we identified spatial distribution of larger soil groups such as Chernosems. In the 2nd stage within the area of a larger group we searched for only those soil-types that corresponds to that group refining spatial resolution this way.