Spatio-temporal assessment of topsoil organic carbon stock change in Hungary

Gábor Szatmári

Institute for Soil Sciences and Agricultural Chemistry, Centre for Agricultural Research, Hungarian Academy of Sciences, Department of Soil Mapping and Environmental Informatics, Budapest, Hungary (szatmari@rissac.hu)

We mapped with 100 m resolution the soil organic carbon (SOC) stock in the topsoils (0-30 cm) of Hungary for the years 1992 and 2010 using quantile regression forest. 10-fold cross-validation was used for checking the accuracy of the spatial predictions and uncertainty quantifications for both years. The performance of the spatial predictions and uncertainty quantifications was appropriate, which was verified by the computed biases (0.15 and 0.30 for 1992 and 2010), the root mean square errors (21.99 and 21.39 for 1992 and 2010), accuracy plots and the G statistics (0.96 for both years) as well. Based on the compiled SOC stock maps, we assessed the spatial and temporal changes of SOC stocks on the whole area of Hungary except artificial surfaces and water bodies. The total SOC stock in the topsoil was found to be 424.41 Tg (1 teragram = 1012 grams) in 1992 and 451.59 Tg in 2010, respectively. Thus SOC stock increased by 27.18 Tg over the respective period. On those areas where the land use types did not change, we observed that the SOC stock increased under forests and pastures, decreased under wetlands and did not change under agricultural areas. On those areas where the land use has been changed during the 18-year period, we found that afforestation has increased the SOC stock, whereas cultivation of pastures has decreased it. Due to soil sealing 34,000 ha of soil have been lost resulting approximately 1.7 Tg carbon loss. We compared our own estimate with other ones provided by global and continental SOC stock inventories. The comparison have pointed out that a SOC stock map compiled by a given country can provide a more accurate estimates at national level. We recommend applying the SOC stock map of 1992 as baseline to be able to track and assess the SOC stock change in Hungary.