Geophysical Research Abstracts, Vol. 9, 10882, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-10882

Digital Soil organic Carbon Mapping using Random Forests

R. Grimm (1), H. Elsenbeer (1), T. Behrens (2), M. Märker (1)

(1) Institute of Geoecology, University of Potsdam, Germany

(2) Institute of Geography, Eberhard-Karls-University of Tübingen, Germany

High resolution spatial estimates of tropical soil organic carbon (SOC) contents are crucial to understanding the role of SOC in the global carbon cycle as well as to incorporating the spatial variation of SOC in ecological and environmental process models. SOC contents are spatially highly variable. In traditional approaches, the mean SOC contents have simply been linked to soilmap units. However, conventional soil profile data is often incomplete, unrepresentative and biased. Apart from that, inherent SOC variability within single soil classes cannot be accounted for by spatially relating mean values of SOC to soilmap units. We aim to demonstrate the process of digital soil mapping for predicting the spatial distribution of SOC by defining a soil inference model using environmental layers of soil classes, parent material, forest history, and various topographic attributes. On the basis of a stratified sampling design, we sampled 165 sites on the 1500 ha Barro Colorado Island (BCI), an island in the Panama Canal, in the depth intervals 0-10 cm, 10-20 cm, 20-30 cm, and 30-50 cm. As a modelling tool we used random forest (RF) – a new entity of ensemble regression tree approaches - which was applied on each depth interval in order to compare vertical and lateral distribution patterns. RF has several advantages compared to other modelling approaches, for instance, the fact that it is neither sensitive to overfitting nor to irrelevant features. The RF based digital SOC mapping approach provided high resoluted spatial estimates of SOC and measures for error rate and predictor importance. The environmental variables that explained most of the variation in the topsoil (0-10 cm) were topographic attributes, indicating gravitational processes. In the subsoil (10-50 cm), SOC distribution was best explained by soil properties incorporated into the soil mapping units. The predicted values for SOC stocks in the upper 30 cm ranged between 38 and 116 Mg ha^{-1} with lowest contents on midslope and highest on toeslope

positions. The digital soil mapping approach introduced in this study might easily be applied to similar landscapes helping to refine the resolution of spatial SOC estimates.