EGU2020-22026
https://doi.org/10.5194/egusphere-egu2020-22026
EGU General Assembly 2020

Predicting the spatial distribution of C stock in Swedish boreal forest using remotely sensed and site-specific variables

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The status of the Cstock at any position in the landscape is subject to a complex interplay of soil-state factors operating at different scale and regulating conflicting processes resulting either in soils acting as sink or source of carbon. Since spatial variability is characteristic of large landscape, key drivers of C stock might be specific for subareas compared to those influencing the whole landscape. Consequently, calibrating separately models for subareas (local models) that collectively cover a target area can result in different prediction accuracy and Cstock drivers compared to a single model (global model) that covers the whole area. The goal of this study was therefore to (1) assess how global and local models differ in predicting the litter, mineral soil and total Cstock in Sweden boreal forest, (2) identify the key variables in forest Cstock prediction and their scale of influence. We here use the Swedish National Forest Soil Inventory (NFSI) database and the digital soil mapping approach to evaluate the prediction performance of the random forest that is calibrated locally for the northern (N-SE), central (C-SE) and southern (S-SE) Sweden and for the whole Sweden (global model). Models were built by considering (1) only site characteristics which are direct record on plot during NFSI, (2) remotely sensed variables and (3) both site characteristics and remotely sensed variables. Local models are generally more effective for predicting Cstock after testing on independent validation data. Using remotely sensed variables with soil inventory indicates that such covariates have limited predictive strength but that site specific covariates show better explanatory strength for C stocks. The latter also were the main drivers for Cstock both locally and globally. Investment could focus in mapping these influential site covariates which have potential for future Cstock prediction models.