Spatial Prediction of the Forest Soil Water Holding Capacities in Temperate Region on a National Scale With Random Forest Models

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Abstract

Soil water holding capacities (SWHCs) is important input factor in hydrological simulation models for sustainable water management. Forests that covered 63% of South Korea are the main source of clean water, and it is essential to estimate SWHCs on a nationwide scale for effective forest water resources management. However, there are a few studies estimating SWHCs on a nationwide scale in the temperate regions especially in South Korea. Fortunately, forest spatial big data have been collected on a national scale, and the nationwide prediction of the SWHC can be possible with this dataset. In this study, spatial prediction of forest SWHCs (saturated water content, water content at pF1.8 and 2.7) was conducted with 953 forest soil samples and forest spatial big dataset. 4 soil properties and 14 environmental covariates were used for predicting SWHCs. Simple linear regression and random forest model were compared for selecting the optimal predictive model. From the variable importance analysis, environmental covariates had as big importance as soil properties had. And prediction performance of the model with environmental covariates as the input data was higher than that of the model with soil properties. Comparing two models, the random forest model could accurately and stably predict SWHCs than the simple linear model. As a result of spatial prediction of SWHCs at the national scale through the random forest model and the forest spatial big dataset, it was confirmed that higher SWHCs were distributed along with the Baekdudaegan, the watershed-crest-line in South Korea.

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