EGU21-12775
https://doi.org/10.5194/egusphere-egu21-12775
EGU General Assembly 2021

High resolution soil hydrology maps as a decision tool for forest planning.

Josef Gadermaier[1], Vanessa Färber[2], Klaus Klebinder[2], and Klaus Katzensteiner[1]
[1]University of Natural Resources and Life Sciences BOKU, Vienna, Forest Ecology, Vienna, Austria (gadermaier.josef@gmx.at)
[2]BFW, Austrian Research Centre for Forests, Vienna, Austria

High resolution, dynamic forest site classification is an innovative tool for decision making in forest management, in particular under the scope of climate change. For a high share of the Austrian forest area, forest soil/site maps are lacking, and, if available, they do not account for the fact that water, energy and nutrient supply may change over a forest rotation cycle. The project FORSITE aims at providing a dynamic site classification system for the Austrian province of Styria, covering 1 mio. hectares of forest area. High resolution maps of chemical and physical soil properties are a key requirement for describing water and nutrient supply, and for modelling scenarios of changing climatic conditions or the effects of management interventions. In order to provide the database for the creation of such maps, a stratified site description and soil sampling design was based on high resolution digital terrain models and lithological maps. The sampling included a detailed description of 1,800 soil pits down to a minimum of 80 cm depth or solid bedrock. Chemical and physical soil parameters (e.g. carbon content, grain size, bulk density, stone content) were determined for samples of the forest floor and up to five geometric horizons of 400 soil profiles. In addition, geologists developed a subsolum geological substrate (SGS) map describing the parent material for soil formation down to a depth of 150 cm. In the current presentation, we describe the steps of modelling maps which support the estimation of the water balance of forest sites. A first step was the development of pedotransfer-functions (PTFs) in order to upscale soil parameters like soil organic carbon content, bulk density, grain size distribution and plant available water storage capacity determined in the laboratory a. to the 1800 field sites and b. to a 10*10 m resolution grid for the whole of Styria. Subsequently, a number of published PTFs for Mualem van Genuchten values based on soil texture, bulk density and organic carbon content were compared to 100 water retention curves which were determined on a subset of the FORSITE soil profiles. These values are required for the parametrization of the lumped parameter hydrological model (Brook 90) which is used to characterize the water supply under present and future climatic conditions. The regionalisation of the single point measurements from the profiles was performed with a Neural Network. Spatial maps SGSs and derivatives of the Digital Elevation Model such as slope, elevation and curvature served as predictors. Information on SGS improves the predictions of soil properties in comparison to standard standard geological maps, because it describes in more detail the relevant layer between soil and bedrock. As Neural Networks were insufficient for describing waterlogging and groundwater influence, random forest models were

applied to a dataset comprised of the ForSite profiles and 4,000 soil profiles from agricultural soil surveys in the region. The resulting high resolution maps of soil properties form the base for the hydrological characterisation of the sites and for the calculation of climate change scenarios.