EGU21-9374
https://doi.org/10.5194/egusphere-egu21-9374
EGU General Assembly 2021

On the role of parent material for predictive mapping of soil properties in mountain forests

Alois Simon[1,2], Marcus Wilhelmy[3], Ralf Klosterhuber[4], Clemens Geitner[5], and Klaus Katzensteiner[1]
[1]Institute of Forest Ecology, Department of Forest and Soil Sciences, University of Natural Resources and Life Sciences Vienna, Vienna, Austria
[2]Department of Forest Planning, Tyrol Forest Administration, Office of the Tyrolean Government, Innsbruck, Austria
[3]alpECON Wilhelmy Geology, Engineering Office for Earth Sciences, Telfes im Stubai, Austria
[4]WLM, Office for Vegetation Ecology and Environmental Planning, Innsbruck, Austria
[5]Institute of Geography, University of Innsbruck, Innsbruck, Austria

Parent material is widely recognised as an important factor for soil formation. Thus, quantitative information on the lithogenetic, geochemical, and physical characteristics of the subsolum geological substrates (SSGS) are essential input parameters for digital soil mapping (DSM). Forming the interface between bedrock – the domain of geologists, and soil – the domain of soil scientists, spatial information on SSGS is however scarce. Recognising these shortcomings, a novel geochemical-physical classification system for subsolum geological substrates has been developed, in order to support DSM at a regional scale. The units of the classification system reflect the properties of the SSGS also considering multilayering structure of quaternary deposits. The basis for the classification are mineral component groups, namely dolomite, calcite, and felsic, mafic, and clay minerals. In order to test the relevance of SSGS for the prediction of spatially continuous physical and chemical soil properties, Generalized Additive Models (GAMs) were applied to the forested area of Tyrol, Austria. The plant-available water storage capacity, as a physical soil property, was predicted with $r^2 = 0.56$. The Ellenberg´s mean soil reaction indicator value for vegetation turned out to be a suitable proxy for soil pH value and was predicted with $r^2 = 0.75$. Topography and associated morphometric terrain features are formative characteristics of mountain areas and, due to its various effects on redistribution processes as well as on water and energy budget of forest sites, are considered as the most essential soil forming factors. Thus, variables derived from digital terrain models, which are available in high spatial resolution, are assumed to be one of the most important predictors for digital soil mapping. In our study we could show however, that SSGS information is the most relevant predictor for both investigated soil properties. In the plant-available water storage capacity model, the predictor variables related to SSGS account for around 76% of the variance explained. Accordingly, a special focus should be placed on the predictive relevance of parent material and the frequently unlocked potential of quantitative geological substrate information. Thus, the newly developed subsolum geological substrate information could stimulate further developments in digital soil mapping, especially in mountain environments.