Topographic and geologic control on soil function evaluation - a case study from South Tyrol

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Abstract

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1. Introduction

Information on soil, a, at least from a human time perspective, non-renewable ressource, is of increasing importance given erosion, soil degradation and soil sealing. It is necessary to know where and where not certain practises are applicable and to adjust land-use planning appropriately. Accordingly, soil function evaluationis an invaluable tool for the future.

In this study, we present the soil evaluation tool *Soil Evaluation for Planning Procedures (SEPP)* and investigate topographic and parent material control of the different soil functions by applying a cross-validated machine learning approach based on availible soil pit information in the Oltradige/Überetsch region of the Autonomous Province Bolzano - South Tyrol.

(Haslmayr et al., 2016)

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2. Data and methods

2.1. *Study area and soil data*

2.2. *SEPP - Soil Evaluation for Planning Procedures*

The software SEPP currently computes a soil function evaluation based on soil pit descriptions. It requires that the pit descriptions are performed following the Austrian Soil classification (Nestroy et al., 2000, 2011) and related mapping manuals. The minimum soil profile site characteristics are local slope, thickness of organic horizons, soil depth, groundwater table, soil parent material, soil type, humus form, altitudinal zone, moisture level, land use ... For each horizon, the minimum characteristics necessary for computing the soil function are the master horizon designation, depth, pH value, proportion of the dominant soil structure type and class membership with regard to carbonate content, soil texture, organic content, abundance of rock fragments, bulk density, soil structure. These class attributes can be substituted by exact values if available. The soil functions, for which 15 different potentials are computed, are *habitat for living organisms* (specifically the potential as habitat for drought-tolerant species, moisture tolerant species, soil organisms and crops), *infiltration and drainage regulation* (minimum, average and heavy precipitation retention capacity as well as groundwater reformation rate), *natural soil fertility* as well as *filter and buffer for pollutants* (heavy metal, organic, acidifying and water-soluble). The result is a grade between 1 and 5 for each soil function potential, with 1 signifying a high potential and 5 a low one.

Potential as a habitat for drought-tolerant species. This potential is calculated

Potential as a habitat for moisture-tolerant species.

Habitat for soil organisms.

Habitat for crops.

Average and minimum precipitation retention capacity.

Retention capacity for heavy precipitation events.

groundwater reformation rate.

Potential for providing nutrients for plants.

Potential as a CO2 sink.

Potential for retention of heavy metals.

Potential for transforming organic contaminants.

Potential as filter and buffer for organic contaminants.

Potential for retention of water-soluble contaminants.

Potential as buffer for acidic contaminants.

3. Results

A first evaluation of the feature selection procedure shows that mostly 2 parameters are sufficient, that is that there is no increase in prediction accuracy by adding more predictors, and most of the time these a combination of a landform classification and a roughness or also local terrain parameter.

4. Conclusion

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