

Threshold values of podzolization process occurrence in soils developed from flysch formations in the Outer Carpathians

Description for the general public

Podzolization process manifesting itself with intensive weathering of minerals, complicated geochemical transformations and translocation of the mineral and organic substances in the soil profile has been studied perceptively since decades. Generally this process occurs in cool, humid climates, in soils developed from coarse mineral material poor in alkali components, under forest or heath vegetation which favours development of thick organic horizons. The Outer Carpathians built of flysch formations are an area where podzolized soils occur sporadically. Its genesis is usually explained by the influence of particular climatic and vegetational conditions or by lithological conditions.

The aim of the project is to determine the conditions of podzolized soils genesis in the areas developed from flysch formations in the Outer Carpathians and to determine threshold values of natural environment external conditions (climate, vegetation, topography, water regime) and of the soil parent material parameters which allow podzolization process occurrence.

The most crucial element to meet the aim of the proposed project will be the research on the soil properties. Soil profiles will be investigated in transects on the slopes of six differentiated areas of the Outer Carpathians (Żywiec Beskids, Little Beskids, Wieliczka Foothills, Gorce Mts., Low Beskids, Bieszczady Mts.). The analysis of the collected data will focus on the parameters which may favour the occurrence of podzolization process in soils, namely permeability of mineral phase (expressed by particle size distribution), parent material mineral and chemical composition, organic matter type and its composition, soil acidification and degree of weathering of soil material in relation to its parent material.

To express the conditions of natural environment and its differentiation several parameters will be used: mean annual temperature and precipitation values and soil temperature and moisture values registered by sensors installed in the subsurface soil horizons; phytosociological relevés conducted on the research stands (in the surrounding of investigated soil pits) and analysis of vegetation cover changes in the last centuries; morphometric analyses of investigated slopes fragments on the basis of Digital Terrain Model using GIS tools; morphological features of stagnic and gleyic conditions and soil redox potential measurements.

To express the advancement of weathering and soil-forming processes in investigated soils quantitative analysis of mineral composition will be conducted and, moreover, indexes of weathering and Mass Balance Analysis of soil profiles will be calculated on the basis of soil and parent material chemical composition. The results of aluminum and iron forms content along with the results of organic matter content will be used to calculate the values of podzolization process indexes. Together with micromorphological analysis these results will allow to quantify the podzolization process in investigated soils. Obtained results of field and laboratory research will be elaborated using statistical methods. Threshold values of podzolization process occurrence in soils developed from flysch regolith will be determined: (1) on the basis of qualitatively and quantitatively expressed differences between the type and advancement of soil-forming processes in the investigated soils; and (2) in the relation to parameterized conditions of the natural environment. GIS tools application will allow to objective delimitation of the areas in the Outer Carpathians where podzolized soils can potentially occur.

The problem of genesis and spatial differentiation of podzolized soils developed from flysch formations in the Outer Carpathians has not been yet a subject of separated and detailed studies. Some of the conducted studies contain information about the genesis and occurrence of podzolized soils, however they are focused on selected areas of the Outer Carpathians (massif of the Babia Góra, Gorce Mts.) or on the influence of chosen soil-forming factors (e.g. introduction of spruce monocultures). The proposed project deals with the problem of podzolization occurrence in the soils developed from flysch formations in a complex and uniform way – both on the level of investigated relations and applied research instruments. Therefore the proposed project gains scientific significance. Such conceptualization of the presented research problem allows to determine the conditions of the soil-forming processes differentiation in a local scale as well as elaboration of the model of this differentiation in the whole area of the Outer Carpathians and, moreover, to generalize the results of the project to the areas built of the flysch formations in the humid climates of temperate zone. Examination of the phenomenon in the area built of material which prevent or hamper podzolization, but where podzolized soils sporadically occur, gives a chance to determine the threshold values of this process occurrence. Moreover, resolution of the alternative presented in the research hypotheses would be a convincing argument in the dispute on the problem if the podzolization is a zonal process (dependent on climatic and vegetational conditions) or depends mainly on soil parent material properties.