



Quantifying the impact of livestock grazing on soil physical properties

Petr Fučík, Antonín Zajíček, and Ondřej Holubík

Research Institute for Soil and Water Conservation, Prague, Czech Republic (fucik.petr@vumop.cz)

Livestock grazing is considered to have a noticeable influence on soil properties, when pedocompaction / soil pore reduction induced either by cattle or sheeps may curtail water residence time and accelerate the beginning and volume of overland flow. However, direct measurements of soil physical parameters and their changes under different pastoral management are seldom reported in central European conditions. Knowledge about these alterations are indispensable for setting the proper, soil and water conservative grazing management in the view of increasing areas of pastures, not only in the Czech Republic.

Impact of cattle grazing on changes of soil properties was studied in three experimental upland catchments in the Czech Republic, differing in soil characteristics and grazing management. Values of soil saturated hydraulic conductivity (K_s), assessed three times a year in-situ during 2012 – 2013 with pressure infiltrometers, were compared for grazed and ungrazed cambisols, pseudogleys and gleysols, for grazing intensity ranging from 0.5 to 2 Livestock units / ha. Soil bulk density (BD) and macroporosity (MP) were determined before and after grazing season every year with ring 100 cm³ steel cylinders. These parameters were measured also on heavily tressed plots by cattle – hotspots - in each catchment.

K_s values on grazed plots were significantly lower (on average by 39 – 66 %) than on ungrazed sites, BD values were reduced on average by 15 % and MP values were lower roughly about 22 % on grazed plots. K_s values on hotspots were lower by 50 – 90 %, BD values by 5 – 18 % and MP values by 8 – 28 % comparing to the rest of grazed areas. Decrease of soil infiltration capacity was influenced by grazing intensity and soil characteristics. The greatest reductions concerning infiltration capacity were manifested in soils being periodically waterlogged (either by surface or by groundwater). A profound influence on the infiltration process was revealed in pasture soils rich on biotite, which together with clay minerals and the pseudogleyization process created an almost unpermeable layer, somewhere already in 25 cm below the surface.

Off the grazing season, soils were recovering and in spring reached nearly similar properties, except for the hotspots, concerning the infiltration ability, as ungrazed soils.

This research was supported by Czech Ministry of Agriculture, grant no. QI111C034.