



Middle-term effects of forest soil compaction on physical, chemical and biological indices at three sites in W-Germany

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The ecology and economy of forest sites are significantly influenced by the application of heavy forest machinery for timber harvesting. In recent literature, these impacts on soil physical and chemical properties have been intensively reviewed. However, up to now, less is known about the alteration of soil biological indices after soil compaction at forest sites. In this presentation the middle-term effects of soil compaction on soil physical (dry bulk density, air permeability), chemical (total organic carbon, nitrogen) and biological parameters (microbial biomass C, microbial respiration) are discussed.

The soil science department of Trier University and the Research Institute for Forest Ecology and Forestry in Trippstadt established three long-term monitoring sites in W-Germany, Rhineland-Palatinate (Kempfeld, Entenpfuhl, Merzalben) for the investigation of soil compaction on forest slopes under practice. The sites are different in edaphic conditions as well as in time-span of monitoring. In Kempfeld, the forest soil is a planosol-cambisol and parent material consists of a mixture of solifluidal moved aeolian material and weathered quartzite. The parent material of Entenpfuhl site is comparable to Kempfeld site, but soil conditions are strongly affected by water logging. Soil type is a planosol to stagnic planosol. The soils from Merzalben site derived from sandstone weathering from Middle Buntsandstein age. The soil type is a podzolic cambisol. The experimental setup comprises the comparison of single- and multi-passed traffic lanes to undisturbed areas for two different sampling depths (0-10, 10-20 cm). Sampling was done in 2016. In Kempfeld, harvesting was conducted in 2003. Soil physical data indicate a deterioration of edaphic conditions (significant increase in dry bulk density and decrease in air permeability) by increasing traffic passes. Soil chemical and biological data also show a decreasing trend (up to 36 %) by enhanced traffic intensity. In Entenpfuhl, logging operations were conducted 11 years ago. Dry bulk density and air permeability are negatively influenced by multi-passed traffic of heavy forest machinery. The results of chemical and biological analysis are highly variable without positive/negative tendencies. The harvesting in Merzalben were conducted 27 years ago. Here, dry bulk density is significant increased and air permeability decreased by increasing traffic passes. For both soil chemical and biological data, a positive trend (increase up to 40 %) can be shown after soil compaction.

The presentation of given data sets should highlight the interaction between soil physical, chemical and biological parameters within the frame of soil compaction by heavy forest machinery. Without further analysis, possible explanations regarding these interactions can only be assumed. Further, given results show clearly that effects of soil compaction on different soil indices are a function of edaphic site conditions.