Nutrient Pools in Oak Forests as a decision support for harvesting intensities (Biomass potential)

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There is growing interest in exploring the potential of woody biomass as a source of renewable, sustainable energy for this region in Northeastern Austria's forests. A fundamental question is how mineral nutrition is affected by harvesting biomass. Losses of plant nutrients exceeding the natural replenishment due to deposition and weathering will ultimately lead to declining growth rates. This study focused on mineral nutrient pool characteristics in deciduous forests in order to investigate the effects of stand age and soil type on exchangeable cations as a basis for sustainable forest management in *Quercus* dominated forests in northeastern Austria. We (i) quantified selected exchangeable cations in the soils of our study area and (ii) identified the effects of stand age, soil type, soil depth and pH on exchangeable cations and cation exchange capacity (CEC). Three soil types (according to WRB system: eutric cambisol, calcic chernozem and haplic luvisol) were considered representative for the area and sampled. Nine permanent *Quercus petraea* dominated plots were selected for our study. Soil pH, nitrogen and the exchangeable mineral elements K, Ca, Mg, Na, Mn, Al, and Fe were determined in five geometric soil horizons. Inventory of aboveground biomass was performed. In our study area, nutrient pools at soil depth 0-50 cm were ($kg.ha^{-1}$): N 3640 – 7210, K 883 - 1510, Ca 1630 – 13630 and Mg 320 - 1850. A comparison of exchangeable cations revealed that (i) Ca was the key element of base cations, (ii) base cations were strongly significantly higher in calcic chernozem, (iii) calcic chernozem had the highest CEC (cation exchange capacity). CEC ranged from 34 to 189 $\mu mol.g^{-1}$ in the entire research area. As expected, CEC was significantly positively correlated (Pearson correlation coefficient 0.661, $P<0.01$) with the pH (H_2O) of the soil. Stand age had no pronounced influence on mineral nutrient contents in the soil. Taken together with the contents of aboveground biomass nutrients in several compartments (stem wood, stem bark, foliage, branches) the data indicates that no nutritional bottleneck results from incorporation of nutrients into the biomass under the present traditional harvest regime. Literature review suggests, however, that phosphorus is a limiting factor at higher biomass extractions (e.g. in case of full tree harvests). Stand age has no large influence on nutrient pools. Soil type, soil depth and soil pH were the most important factors to influence the nutrients and CEC.