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Soil sustainability study in Lithuanian alien forest stands

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Tree species are shifting their natural ranges in response to climate changes (Saltré et al., 2013). Northern red oak has originated from North America, but was planted in Europe already in twentieth century. At present, it is considered as invasive species in Poland and at invasive stage in the Lithuanian forests (Riepsas and Straigyte, 2008). European larch naturally grows in Central Europe, but its range has been extended by planting it as far as the Nordic countries. According to a pollen study in peat soils, European larch naturally grew in Lithuania in the sixteenth century and was reintroduced 200 years ago (Jankauskas, 1954). Therefore, the global warming could accelerate the expansion of European larch and Northern red oak into Lithuanian forests. An urgent need appeared to evaluate an impact of those warmth-tolerant species on soil mineral chemistry and quality. New results on the determination of mineral weathering rates in alien forest stands using a *PROFILE* soil chemistry model were obtained during a doctoral study at the Institute of Forestry. Soil minerals were studied by a Scanning Electron Microscopy at the Institute of Geology and Geography. The results provided a lot of new information on soil weathering rates in Lithuania.

The 47 and 157-year-old European larch (*Larix decidua* Mill.), 45 and 55-year-old Northern red oak (*Quercus rubra* L.) plantations and adjacent perennial grasslands were chosen for this study. The soils were classified as *Luvisols* and were developed from glaciofluvial deposits. The PROFILE model requires data of climate conditions (mean annual temperature and precipitation), chemical parameters of atmospheric deposition, forest plantation dendrometric and chemical (wood, foliage litter fall) characteristics, soil physical characteristics and mineral composition.

A cation weathering rate (sum of Ca+Mg+ K) is 30% higher in a soil under the Northern red oak than in adjacent perennial grassland. Meanwhile, cation weathering rates in the differently-aged European larch plantations do not differ much. The obtained results suggest that the low calculated rates of cation release (13.1 ± 0.4 mmol $m^{-3}yr^{-1}$) in grasslands and the stable rates (62.3 ± 7.4mmol $m^{-3}yr^{-1}$) observed in the differently-aged larch plantations could sustain the quality of soil. The higher mineral weathering rate in the red oak forest ecosystem could be related with a faster nutrient cycling.

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