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Landscape ecological succession with Norway spruce *Picea abies* in abandoned farmland in Latvia

Future scenarios of land-use change in Europe for the period to 2030 predict a decline of agricultural land, as a result of land abandonment and afforestation (Stoate *et al*. 2009). This is reflected by the actual trend in Latvia. The process of landscape-ecological succession can be very diverse in spatial character, as well as in the composition of tree species colonizing fields (Ruskule *et al.* 2012). One typical scenario, which does not correspond with classical models of ecological succession, is colonization of abandoned fields by Norway **s**pruce *Picea abies (L.) H.Karst.* The aim of our study is to establish causes and influencing factors, which determine colonization of fields by *P. abies.*

Mapping patches of afforestation reveals that a mosaic pattern is developing where P abies is colonizing abandoned fields, formed by scattered woody patches across fields and, in some cases, in the ecotone between forests and fields. Within the herbaceous layer, perennial grasses typical of cultivated grasslands dominate (*Dactylis glomerata*, *Phleum pratense* and *Agrostis tenuis*). Mineral topsoils within the sample sites are mostly comprised of loamy sand or sandy loam. The distribution of *P. abies* is related to scarce, low to medium high-grass communities with *Vicia cracca, Fragaria vesca*, *Leontodon hispidus*, *Trifolium repens* and other herbs. Establishment of shade-tolerant *P. abies* has influenced the species composition within these sites by competing with herbaceous species and eliminating tall grasses, enabling development of moss cover, as well as invasion of other tree species, e.g. *Betula pendula*.

Soil properties have an important role in development of patches of natural regeneration. The Principal Component Analysis (PCA) has revealed a positive correlation between the distribution of tree cover (r=0.35) and sand content (r=0.97), as well as a negative correlation with the content of loam (r=-0.78) and silt particles (r=-0.87), of soil (fig. 1.a.).

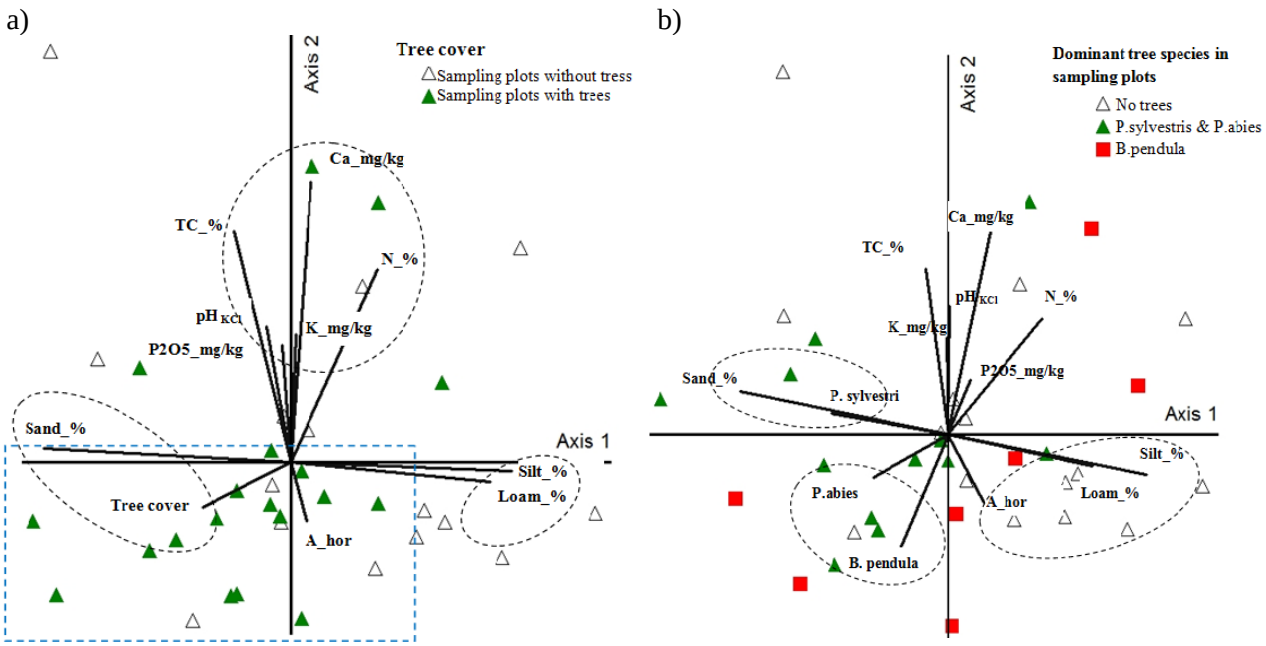

Fig. 1 PCA ordination of the sampling plots based on soil properties and tree cover.
A_hor – thickness of Ap horizon; TC_% - total organic carbon content; N_% - total nitrogen concentration; P205 – total phosphorus concentration; Ca_mg/kg - exchangeable cation Ca^{2+} concentration; K_mg/kg – exchangeable cation K^{+} concentration; pH_{KCl} – soil pH defined in 1M KCl solution.

The ordination of Ap horizon soil properties along with dominant tree species in patches of natural regeneration reveals a positive correlation between sand content (r=0.94) and presence of *P. sylvestris* in patches of natural regeneration (r=0.53). Although distribution of *P. abies* and *B. pendula* is also related to soil texture, the correlation between these factors is not statistically significant.

Colonization of formerly cultivated farmland by tree species is relatively slow because it is hindered by the dense herbaceous layer, which is determined by soil properties. *P. abies* is able to compete with grass species, creating more favourable conditions for invasion of other tree species.

References

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