Submitted Abstract

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Title	Seed Origin And Species-Specific Differences In Resilience To Ungulate Browsing Enhance Regeneration Problems In Mountain Forests.
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Abstract

Local climate and ungulate browsing are two major factors that affect tree regeneration and genetic adaptation in Central European forests. The process of regeneration is generally longer in mountain forests than at lower elevations. This is among other due to the shorter growing season and thus lower height increment. With the climate change, the process could accelerate. However, it is necessary to investigate the separate and joint effects of seed origin (and climate) and ungulate herbivory.

The aim of this study was to analyse the influence of intraspecific genetic variation on the sensitivity and resilience of tree species to stress due to frost and simulated winter browsing and the consequences regarding seedling water-use efficiency.

In a genecological experiment, we investigated quantitative genetic variation within and among 72 - 90 provenances of Abies alba, Picea abies, and Fagus sylvatica. Light and heavy ungulate browsing in spring was simulated, the growth reactions were assessed and for Abies also physiological traits.

For Abies, frost damage and clipping resulted in reduced height growth in the first year after the stress and reduced height for at least two (clipping) to four (frost) vegetation seasons. Sapling biomass and diameter increment decreased after heavy clipping. For Picea and Fagus, the effect of this single simulated browsing event disappeared over time for the growth traits. Reduced growth only persisted for Picea saplings after frost damage.

The ‘reaction type’ after browsing seems to be species specific but independent of seed origin. In contrast, the time lag between simulated browsing and formation of a clear new leader shoot increased for Abies with lower temperatures at the seed source. Differences in sapling resilience to stress enhanced the existing differences among provenances. Lowland provenances with warmer climates grew faster, and in Picea also qualitatively better, and recovered faster (Abies) or more efficiently (Picea) to leader shoot loss. From this side, here seems to be no clear evidence of a tradeoff between adaptation to climate change and resilience to stress.

However, browsing lowered seedling water-use efficiency (decreased δ13C) of Abies alba. Therefore, browsing could exacerbate the regeneration problem in mountain forests via two mechansim; loss of height coupled with slow/inefficient response of mountain provenances and increased risk during drought.