

Root rot as a consequence of climate and stand limitations of northern red oak

Thomas L. Cech, Michael Brenn, Katharina Schwanda

The northern red oak (*Quercus rubra*) is one of the tree species that are in the focus of silvicultural considerations as a replacement for indigenous species no longer adapted due to climate change. Here we report two cases where northern red oaks were damaged to a threatening extent by the root rot pathogen *Gymnopus fusipes* (spindleshank mushroom) on two sites where the requirements of the tree species were not met. The comparison of climate, soil and increment data shows that the likelihood of infection and the spread of rot are largely controlled by the factors precipitation and certain soil properties. A combination of drought stress, low water storage capacity and high lime content in the deeper soil layers promotes infections by the spindleshank mushroom, to which large parts of the root system fall victim over the course of several years.

Does management of crown breakage reduce subsequent bark beetle infestation in Norway spruce forests?

Markus Kautz, Horst Delb

Tree tops broken by snow, ice or storm events may substantially increase the risk for subsequent bark beetle infestation in Norway spruce forests, although at a lower magnitude compared to windthrow. The state of knowledge, however, e.g. regarding risk quantification following crown breakage or the role of crown management, is scarce. This case study examines the risk of infestation by two most relevant bark beetle species (*Ips typographus*, *Pityogenes chalcographus*) at broken crowns, as well as at remaining stumps and unbroken neighboring trees over the course of a season – in each case with and without the timely removal of the crown material. Due to the high beetle densities, a very high risk of infestation of almost 100 % was observed at broken crowns, with clear species-specific diameter preferences. Stumps with a small amount of remaining crown (< 20 %), and stumps with a lower social status (Kraft class 3), showed higher infestation risk. The timely management of broken tree crowns could reduce infestation risk both for stumps and for unbroken neighboring trees. Based on empirical data, this study contributes to answering open questions that are relevant in forestry, and emphasizes the importance of applying management measures when crown breakage in spruce stands had occurred.

The development of ash on the example of three strict forest reserves in Upper Bavaria

Vinzenz Beham, J. Philipp Benz, Markus Blaschke

For this study three strict forest reserves in Upper Bavaria "Echinger Lohe", "Fasanerie" and "Neukreut" were observed. The used data consisted of older stand inventories and one new

survey conducted in 2020. To determine the status of the ash dieback caused by the fungus *Hymenoscyopus fraxineus* the degree of crown thinning was assessed using the scale described by Lenz et al. (2012a). Indications for an infestation with *Armillaria* spp. and ash bark beetle were also noted. It was shown that all ash stands were noticeably damaged and no ash trees free of ash die back symptoms could be found. However, the reduction in standing volume was over the last five years (three years in the case of "Echinger Lohe") significantly worse in the two drier stands compared to the waterlogged stand. The two dry stands "Echinger Lohe" and "Fasanerie" lost 56 % and 57 % respectively, while the moister stand "Neukreut" only lost 18 % of its standing volume over the last three or five years. *Armillaria gallica* and ash bark beetle could be found on all three sites but were much more frequent at the dry sites than the moist site. *Armillaria gallica* was the only *Armillaria* species that could be identified, which suggests that the observable root rot and rhizomorphs were mostly caused by this species. However, other *Armillaria* species could still be present.

Bundesforschungs- und Ausbildungszentrum für Wald, Naturgefahren und Landschaft (BFW)
Austria, 1131 Wien, Seckendorff-Gudent-Weg 8 | Tel.: +43 1 878 38-0

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Autor: Gottfried Steyrer