Vandekerkhove, K. et al. (2018): Very large trees in a lowland old-growth beech (Fagus sylvatica L.) forest: Density, size, growth and spatial patterns in comparison to reference sites in Europe. Forest Ecology and Management 417: 1-17.

Reference: Vandekerkhove, Kris, Margot Vanhellemont, Tomáš Vrška, Peter Meyer, Vath Tabaku, Arno Thomaes, Anja Leyman, Luc De Keersmaeker, Kris Verheyen (2018): Very large trees in a lowland old-growth beech (Fagus sylvatica L.) forest:
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Abstract

The frequent occurrence of very large trees (diameter at breast height DBH ≥ 80 cm) is a typical element of both primary and secondary old-growth forests. We analyzed the characteristics of very large trees in one of the few stands of lowland old-growth beech forest in Northwestern Europe, regenerated around 1775 and left unmanaged since 1986. We examined their density, diameter range, increment, mortality rate and spatial distribution, based on repeated full dendrometric surveys. In order to evaluate the results, we compared them to original datasets from primary and secondary old-growth beech forests in Europe, and an extensive reference table, compiled from inventories and literature.
In our study site, the density of very large trees increased from 31.5 to 34.3 trees/ha over the last 25 years, reaching a median DBH of 97 cm (mean 98.9), with the largest tree attaining a DBH of 159 cm. Although the trees were over 240 years old, they still showed an average DBH increment of 4.75 mm/year and a low mortality rate (0.89% /year), indicating that they were still vital. These figures are remarkably high compared to other old-growth beech forest reference sites, where the density of very large trees generally varies between 5 and 20 trees ha−1 (median value 13.1), with a median diameter of 85–90 cm and maximum DBH for beech trees rarely exceeding 100–130 cm.

The regular spatial distribution pattern of the very large trees in the studied stand clearly differed from a typical old-growth stand, in which very large trees are randomly distributed. Over the last 25 years though, because of random mortality and ingrowth, the spatial distribution gradually became more random.
The extraordinary densities and sizes of the very large trees in our study site can be explained by the favorable climate and site conditions that promote high increments, in combination with the former management interventions of tending and thinning that resulted in continuous non-suppressed growth. Although derived from a very specific case with particular conditions, our observations may be relevant to other beech forests, as they tend to reset certain baseline assumptions for tree size and longevity potential of beech in Northwestern Europe.

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stand structure
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