

## BEETWIND (Intermediate report)



### Acclimation of Beech Trees to change in wind mechanical stress following thinning

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**Context** — Wind is an environmental factor that is increasingly becoming important to be taken into account in forest production. Indeed, the growing tree is constantly adjusting its growth to external conditions and in particular to the mechanical strains resulting from the wind loading. This thigmomorphogenetic reaction modifies the distribution of produced biomass in different tree compartments.

**Objectives** — In a silvicultural context, focused on a regular beech stand, the main objective is to point out the importance of wind-induced changes in growth and wood properties in particular after thinning.

**Approach** — The proposed study is based on an experiment installed since 2015 in the Hays forest near Nancy. Four groups of ten trees were monitored and for each group a different treatment modifying or not the interactions with the wind was carried out via thinning and guying. Below the anchor point, guying strongly reduces the mechanical strains responsible for

a thigmomorphogenetic reaction. In addition to the monitoring of radial tree growth, and wind induced mechanical strains at one height associated with meteorological measurements a final characterization of the trees and sampling of wood specimens to answer multiple questions about the effects of the different treatments on the tree development, the formed wood, its properties and the strength of anchorage completed the data.

**Key results —**

- Depending on the year, mechanical stimulation due to wind induced radial growth increment ranging from 53% to 89% of the increment due to thinning, compared to control trees.
- In our experiment, no difference in height growth was observed between the treatments.
- No significant difference of wood properties was highlighted, between the leeward and neutral sides of the thinned trees.

**Main conclusions including key points of discussion —**

- Important differences of radial growth were observed between the treatments during four years. Absence of mechanical stimulation in guyed trees reduces the radial growth increment. This quantifies the importance of the mechanical stimulation due to wind in the regulation of the secondary growth of trees in a natural environment for thinned trees as well as for control trees.
- Contradictorily to previous works (Meng et al. 2006, Nicoll et al. 2019), and results obtained in green-houses conditions we did not observe an effect on primary growth induced by guying. Explanations could be a weakest apical control for beech compared to conifers, or in our case a larger portion of the guyed trees free to sway, inducing a weak signal difference between the upper parts of trees belonging to different treatments.
- In such natural context, for thinned trees free to sway, there was no significant difference on the wood properties (MFA, MOE, MOR, Density) between leeward and neutral sides with respect to the directions of the most frequent and strong winds.
- The FEM modelling workflow allowing simulations of the strength anchorage initially developed for Maritime Pine by UMR ISPA has been adapted to take into account our extracted root systems digitised by TLS and artificially completed for the missing parts of the roots. The simulation trials provided encouraging results justifying to go further.

**Future perspectives —** After one year, mainly dedicated to the data collection, data analysis has just begun.

**Valorisation —** Two communications are accepted in the IUFRO Wind & Trees Conference in Rotorua NZ, 24-28 February 2020.