QuaPla

Suivi des déformations sur l'arbre sur pied – Mesure de l'ancrage – Répartition de la biomasse

Variabilité des propriétés et des structures de bois issus des plantations innovantes en Lorraine : qualité bois et son implication biomécanique

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Work packages: *WP2* *WP3*

Context —
In the present context of global changes, forest will face increased intensity and frequency of wind storms (Baatsen et al., 2014) together with changes in silvicultural practices aiming to lower the tree stem density to increase the forests' resistance to drought (Bottero et al., 2017). Wide-spaced forests may be obtained by an increase of thinning operations or by decreasing the initial planting density. However, every thinning is followed by a period of mechanical vulnerability that highly increases damages in the forest in case of strong wind (Wallentin and Nilsson, 2014). This vulnerability is transitory because wind sways triggers through the perception of mechanical strains the thigmomorphogenetic syndrome (Moulia et al., 2015). This adjustment of growth and morphogenesis ensures a progressive increase in mechanical resistance of the tree against wind loads. Acclimation is strong mainly in young trees. Therefore, we may hypothesize that trees exposed to the wind from their young stages (wide spaced plantations) will exhibit higher resistance against wind compared to trees submitted to successive thinning in latter stages of their growth. On the other hand, stronger development of the crown in the basal part of the tree growing in wide spaced forest will lead to lower wood quality due higher proportion of juvenile wood.

Objectives —
Assess the gain/loss in wood quality and in the resistance against wind in Douglas fir forest issued from innovative sylviculture (low initial planting density) compared to common sylviculture (regular thinning)

Approaches —
Two 50yrs-old Douglas-fir plots submitted to contrasted sylviculture (low initial planting density vs frequently thinned plot) were used for the study. Six trees of different social status were samples in each plot. First, strain regime was followed in both plots during two months to quantify perceived mechanical signals. After this monitoring phase, trees were pulled out in order to measure the anchorage strength. We measured the biomass distribution, the stem shape and collected samples for stem analysis and wood structure and mechanical properties characterisation.

Key results —
- The present study offers the first quantification of the canopy shading effect (difference in the mechanical strain perceived by trees of different social status).
- Surprisingly, mechanical strains perceived by trees in the low initial density plot were higher compared to the strain perceived by trees in the thinned plot.
- Analysis of pulling tests together with the stem analysis and wood structure and properties characterisation are under process.

Main conclusions including key points of discussion —
Higher mechanical strains perceived by trees in the low initial density plot indicate that exposure to wind sways in young stages do not lead to not better acclimation to wind at the stem level. Further analysis will focus on pulling tests results, as root compartment may be the weak point of the resistance against wind for trees of this size (35m height).

Perspectives —
Analysis of pulling tests will give clues to understand the global tree resistance against wind (not compartment dependant) in function of applied sylviculture. Further, wood structure and mechanical properties characterisation will allow for quality assessment of wood issued from low initial density plantations.

Valorization —
Poster : Noyer, E., Constant, T., Ningre, F., Seifert, T., Dlouha ; J. ***Impact des différents itinéraires sylvicoles sur les sollicitations mécaniques perçues par les tiges de Douglas : snapshot à 50 ans.*** *10eme journées scientifiques du GDR Sciences du Bois, 17, 18 et 18 novembre 2021. Montpellier*

Leveraging effect of the project—
Renewal of the collaboration with Freiburg University (Prof. Thomas Seifert group). One German student will come for his training period in summer 2022 and a common workshop will be organized in June 2022.