PROJECT: ASPEN DROUGHT

Date: **04.10.2021** **REPORTING**

ID: 444

PROJECT TITLE

Investigating the effects of drought stress on adaptive profile of P. tremula genotypes using chlorophyll fluorescence kinetics and hyperspectral imaging

CONSORTIUM

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SUMMARY OF THE REPORT

European aspen (*Populus tremula L.*) is a widespread species with its distribution range covering most parts of Europe and Asia and a valuable tree species for diversity of boreal forests. Climate change will increase the forest die-back due to heat and drought. Because extreme weather conditions, like prolonged drought, can affect especially seedling establishment, tolerance to water stress in the early plant development is crucial.

We investigated the tolerance of European aspen to drought stress and recovery from the stress during early plant development. This experiment was based on non-destructive, high-throughput plant phenotyping techniques: monitoring the daily growth parameters bi-weekly chlorophyll fluorescence kinetics, combined with hyperspectral imaging at National Plant Phenotyping Infrastructure (NaPPI) facilities in Helsinki, Finland. We observed that the effects of drought stress on P. tremula seedlings induced physiological and biochemical changes detected in the growth, photosynthesis, and foliar spectral reflectance, indicating early-stage markers assessing plant condition could then be developed.

European aspen clones from a random sample from a forest stand in the Czech Republic were used. The cloned plantlets were compared in control and water-stressed (drought) conditions and during drought stress recovery in the large NaPPI Plantscreen™ Conveyor System Phenotyping facility during September- October 2020. Altogether 198 aspen saplings of 33 clones were phenotyped for six weeks for responses to drought and a subsequent recovery period.

We aimed to find out: (1) Does drought-stressed P. tremula show clonal variation in foliar spectral reflectance and in chlorophyll fluorescence kinetics during the early plant development? (2) Is there a correlation among foliar spectral reflectance indices and chlorophyll fluorescence kinetics parameters/indices? (3) Which indices could be used to detect the recovery from the drought stress? (4) What is the recovery rate of the *P. tremula* genotypes after exposure to drought stress, and does it vary among clonal replications? Finally, we aim to find foliar spectral reflectance indices and/or chlorophyll fluorescence kinetics parameters that can be used to predict early-age drought stress tolerance in *P. tremula*.