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Abstract of Ph.D. thesis entitled: SOME PHYSIOLOGICAL PROCESSES AND THE HEIGHT GROWTH OF BEECH *FAGUS SYLVATICA* L. AND FIR *ABIES ALBA* MILL. LOWER ADVANCED GROWTH IN DIFFERENT STAND STRUCTURES

This doctoral thesis is a source of information about photosynthesis activity, contents of photosynthetic pigments, leaf morphological characteristics, and height growth of young beech *Fagus sylvatica* L. and fir *Abies alba* MILL. in different stand structures; as well as the effect of stand structure on understory light condition in the unmanaged forest and the managed stands.

This thesis has three major purposes: (1) to compare the tree diameter complexity in the unmanaged forest and managed stands; (2) to determine how photosynthesis activities of beech and fir are affected by different levels of the light availability; (3) to compare the photosynthesis of beech and fir between unmanaged forest and managed stands.

Data were collected between 2015 and 2018 in the Świętokrzyskie Mountains. Sample plots representing the growing-up developmental stage were randomly selected; 30 plots were in the unmanaged forest (Święta Katarzyna; ŚKAT), and 30 plots were in managed stands (Kielce; KIE). Percentage canopy openness from hemispherical photographs was used as an estimation of the light condition under the unmanaged forest and the managed stands. The diameter at breast height (DBH) distribution patterns were determined using hierarchical cluster analysis (HCA). Photosynthetic performance of the young trees was assessed by chlorophyll *a* fluorescence, gas exchange and analyses of chlorophyll and carotenoid concentrations in leaves of beech and needles of fir.

The distinguished DBH distribution patterns indicated there was lower tree size diversity in the unmanaged forest than in the managed stands. Moreover, in the unmanaged forest, a multi-storied structure has developed into one-storied and two-storied structures, while in the managed stands thinnings have maintained a multi-storied structure.

Both species showed pronounced differences in photosynthetic efficiency when grown under different canopy openness. Beech trees showed an increase in maximum electron transport rate (ETR_{MAX}) and net photosynthesis (P_N) with canopy openness until a certain threshold was reached. Maximal quantum yield of PSII (F_VF_M) of beech remained mostly below 0.8 indicating of photoinhibition in canopy openness above 34%. A steady increase in ETR_{MAX} and P_N over the entire range of canopy openness explored was found only for the fir. However, the results of the study revealed that the fir exhibited lower plasticity of its leaf morphological and physiological traits, e.g. leaf mass per area (LMA), chlorophyll and carotenoid content, in response to different understory light availability.

According to the three yield components (ϕ_{PSII}, ϕ_{NPQ}, ϕ_{NO}), as well as ETR_{MAX} and P_N parameters, the different photosynthetic response between the unmanaged forest and the managed stands was evidenced for both species. There was a positive correlation between ETR_{MAX}, P_N parameters and height growth of young beech.

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