

## ABSTRACT

The present Master thesis focuses on evaluation of CO<sub>2</sub> concentration and irradiance on selected leaf anatomical parameters of European Beech (Common Beech) *Fagus sylvatica* L.. The process of photosynthesis is remarkably determined by numerous external factors, among them by atmospheric CO<sub>2</sub> concentration and irradiance and is closely correlated with leaf anatomical parameters. One of these most important anatomical parameters affecting the net assimilation rate is an internal leaf surface, which corresponds to mesophyll area available for gas exchange.

Experimental material of the study was sampled from the leaves of juvenile trees of *F. sylvatica* planted in 2005 and growing under ambient (390 ppm, AC) and elevated (700 ppm, EC) CO<sub>2</sub> concentrations on the experimental site of the Global Change Research Center AS CR at Bílý Kříž in the Beskydy Mountains. Sun and shade leaves were sampled from trees of both CO<sub>2</sub> treatments in two seasons 3 years apart (2009 and 2012). To determine leaf anatomical parameters, the stereological methods were applied, which yield unbiased estimation of measured parameters, particularly the Fakir method for internal leaf surface determination. The EC effect was observed on the leaves sampled in 2009 only in the decrease of proportion of intercellular spaces in mesophyll. In 2012, the EC treated leaves exhibited higher thickness of palisade parenchyma and a trend of higher leaf thickness and an increase in internal leaf surface. The effect of irradiance was more pronounced comparing to the effect of CO<sub>2</sub> concentration. Leaves exhibited different parameters in dependence on irradiance: leaf thickness, thickness of mesophyll and both parenchymas and internal leaf surface. The measured parameters reached higher values for sun leaves irrespectively of CO<sub>2</sub> concentration. The parameter of density of internal leaf surface reached more significant changes between sun and shade leaves under conditions of AC comparing to EC treatment. The content of photosynthetic pigments in leaves decreased in leaves growing under elevated CO<sub>2</sub> concentration and higher irradiance. Data obtained in both years did not prove uniformity of tree response to long-term elevated CO<sub>2</sub> concentration treatment.

Obtained results were discussed with literature, which report the values of internal leaf surface determined using model-based methods. The stereological method of Fakir was the first time applied for the bifacial leaf in the present study. Importance of contribution of the present thesis lays in originality of the methodical approach used with the application of stereological methods. The stereological Fakir method was found to be applicable universally for estimation

of the internal leaf surface from the various leaf material with regard to its particular anatomical structure