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Using chronosequence method for assessing change in forest growth conditions

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Forest growth is commonly estimated using permanent plots and/or chronosequence. The chronosequence method applies substitution of time with space. The assumption of chronosequence method is that differences between various forest stands are solely due to differences in age, while soil, climate and other factors are equal. Therefore, plots chosen for chronosequence should be as similar in their properties as possible, except for the age.

However, in changing environment (due to global climate change, or local anthropogenic influences) the substitution of time with space is problematic because in such case the basic assumption of chronosequence is not met.

Our study was conducted using chronosequence method in a lowland pedunculate oak forest near Jastrebarsko, Croatia. We chose 7 forest compartments of different age and similar site and stand characteristic to obtain the function of average stand stock. Applying derivative with respect to time to the function, we obtained the rate of change of stock (approach No 1). Simultaneously, we measured tree circumference increments at breast height at four plots per age class using a total of 565 dendrometer bands installed on all trees (dbh>5 cm), together with annual tree height increments. Potential annual thinning was estimated according to the forestry regulations for thinning intensity for stands with similar properties. Rate of change of the stock for each age class was calculated as a difference between actual annual growth rate and potential prescribed thinning (approach No 2).

Estimates for the stock rate of change obtained from two approaches were compared. Results can be useful in assessing if a forest growth conditions in a given area have changed. Assuming that the management (i.e. thinning intensities, rotation length etc.) has not changed during last decades, as is the case in Croatia, the difference, if observed, could be linked with the changes in growing conditions for the forest in question.