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# Carbon sequestration in mixed deciduous forests: The importance of mid-storey trees for forest productivity

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Forests play an important role in climate regulation due to carbon sequestration. However, a deeper understanding of forest carbon flux dynamics are often missing due to a lack of information about forest structure and species composition, especially for non-even-aged and mixed forests. In this study, we combined field inventory data of a mixed deciduous forest in Germany with an individual-based forest gap model to investigate daily carbon fluxes and to examine the role of tree size and species composition for the overall stand productivity. Simulation results show that the forest model is capable to reproduce daily eddy covariance measurements ($R^2$ of 0.73 for gross primary productivity and of 0.65 for ecosystem respiration). The simulation results showed that the forest act as a carbon sink with a net uptake of 3.2 $t_C$ $ha^{-1}$ $yr^{-1}$ (net ecosystem productivity) and an overall gross primary productivity of 18.2 $t_C$ $ha^{-1}$ $yr^{-1}$. At the study site, medium sized trees (30-60cm) account for the largest share (66%) of the total productivity. Small (0-30cm) and large trees (>60cm) contribute less with 8.5% and 25.5% respectively. Simulation experiments showed, that species composition showed less effect on forest productivity. Stand productivity therefore is highly depended on vertical stand structure and light climate. Hence, it is important to incorporate small scale information's about forest stand structure into modelling studies to decrease uncertainties of carbon dynamic predictions. Experiments with such a modelling approach might help to investigate large scale mitigation strategies for climate change that takes local forest stand characteristics into account.