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# A modelling study of the responses of evapotranspiration and net ecosystem exchange of $CO_2$ on species composition changes in a boreal forest ecosystem

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Climatic changes may have significant impacts on forest ecosystems. They can result in changes of tree species composition, forest productivity and soil carbon sequestration. A global warming which is expected to be particularly large at higher latitudes will affect boreal forests probably more strongly than forests in other latitudinal zones (e.g. IPCC 2001). It can be expected that the greatest changes may occur at the southern boundary of the boreal forest zone, where the boreal coniferous forest is likely to give way to broadleaf species. How such vegetation changes will affect water and $CO_2$ budgets of the forest area is not known yet.

Within the framework of this study effects of species composition changes (coniferous and broadleaf species) on evapotranspiration and Net Ecosystem Exchange (NEE) of $CO_2$ in a boreal forest ecosystem were determined using an one-dimensional SVAT (Soil – Vegetation – Atmosphere Transfer) model Mixfor-SVAT (Oltchev et al. 2002, Falge et al. 2005). Mixfor-SVAT was developed to describe the vertical energy, water and $CO_2$ exchange within and above mixed and vertically structured forest stands. It uses realistic vertical structure of forest stand and allows simulating the $H_2O$ and $CO_2$ exchange between forest ecosystem and the atmosphere taking into account transpiration, water uptake, photosynthesis and respiration of different tree species in the forest overstorey and understorey, as well as evaporation and respiration of the soil and dead biomass respirations.

Annual patterns of evapotranspiration and NEE of $CO_2$ were modelled for five types

of forest stands characterised by different admixture of spruce and broadleaf species. As input meteorological parameters in our modelling experiments the measured meteorological air temperature, humidity, wind speed, precipitation rate and global solar radiation data for one year test period were used.

Results of modelling experiments showed a relatively high dependence of forest evapotranspiration and NEE of $CO_2$ on species composition. This effect is strongly depended on environmental and soil moisture conditions and it has a clear seasonal trend.

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