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Leaf photosynthesis/respiration relationships of different tree species in the northwestern part of Russia.

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Measurements of leaf photosynthesis, respiration and stomatal conductance of Norway spruce (*Picea abies* (L.) Karst), Silver (*Betula pendula* Roth), White (*Betula pubescens*) and Karelian (*Betula pendula var. carelica*) birches were provided using the portable photosynthesis system LI-6400 (Li-Cor, USA) on the experimental plots of the Forest research Institute of Karelian Research Center of RAS in Petrozavodsk, Russia. LI-6400 allows to provide the measurements of photosynthesis and respiration rates of individual leaves at various PAR, temperatures, humidity and concentration of CO_2 in the measuring chamber. During the field campaigns in 2011 the CO_2 and light response curves of photosynthesis of leaves under different air temperatures as well as the temperature response functions of dark respiration (R_d) of the leaves of different species were estimated. The measuring program is include also the measurements of nitrogen content in leaves.

The method suggested by Sharkey *et al* (2007) was used to estimate the maximal velocity of Rubisco for carboxylation (V_{cmax}), the rate of electron transport at light saturation (J_{max}), photorespiratory compensation point as well as the rate of use of triose phosphates (TPU) that characterizes the availability of internal inorganic phosphates (C_i) in leaves for Calvin's cycle. It was assumed that the initial slope of the relationship between leaf photosynthesis rate and CO_2 concentration in sub-stomatal air space ($C_i < 200$ ppm) can be considered as an area of Rubisco limitation of photosynthesis. The upper part of CO_2 response curve from approximately 300 ppm and higher is influenced by, first of all, the rate of regeneration of RuBP, and after that by availability of inorganic phosphate in leaves. The temperature dependences of V_{cmax}, J_{max} and TPU were estimated using the statistical analysis of V_{cmax} and J_{max} data set using equations suggested by Medlin *et al* (2002). Temperature dependence function of TPU was derived using algorithm proposed by Sharkey *et al* (2007).

The results of field measurements in summer 2011 show a relatively weak differences among V_{cmax}, J_{max} and TPU, and also R_d for Silver, White and Karelian birches. The maximal values of V_{cmax} (T=25°C) are obtained for the Karelian birch (V_{cmax} (T=25°C) = 117 μmol m^{-2} s^{-1}), and the minimum values - for the Silver birch (V_{cmax} (T=25°C) = 97 μmol m^{-2} s^{-1}). The maximum values J_{max} (T=25°C) are obtained for the White birch (J_{max} (T=25°C) = 164 μmol m^{-2} s^{-1}), and minimum also for the Silver birch (J_{max} (T=25°C) = 157 μmol m^{-2} s^{-1}). Values TPU max are varied from 11.0 to 12.3 μmol m^{-2} s^{-1}, and R_d (T=25°C) - from 2.0 to 2.4 μmol m^{-2} s^{-1}.

The results of provided leaf photosynthesis, respiration and stomatal conductance measurements were used in the process-based Mixfor-SVAT model (Olchev *et al* 2002, 2008) to derive the possible response of CO_2/H_2O budgets of Karelian forest ecosystems to future climatic changes.

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