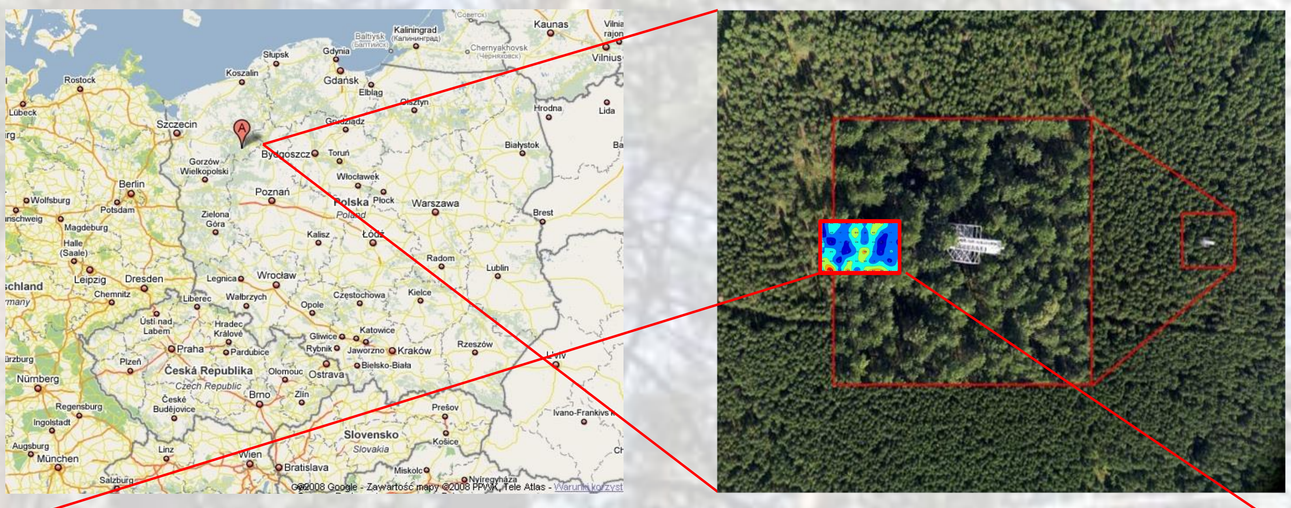
Forest floor respiration of Tuczno Scots pine stand

Marek Urbaniak [1)], Marian Pavelka [2)], Bogdan Heronim Chojnicki [1)], Radosław Juszczak [1)], Eva Dařenová [2)], Marcin Baran [1)], Alina Danielewska [1)], Klaudia Ziemblińska [1)], Janusz Olejnik [1,2)]

[1)] Poznan University of Life Sciences,

[2)] CzechGlobe - Global Change Research Centre AS CR, v.v.i.

During the period between 20th and 25th August 2012 an experiment consisting of the measurement of forest floor CO_2 efflux was carried out. For this purpose, one single manual chamber systems were used. Measurements were taken at 60 collars located on a rectangular plot 25m x 45m, and each measurement cycle lasted from 2.5 h (in the daytime) to about 3.5 h (at night). This research area was located in the range of footprint of the Eddy-covariance (EC) tower. Results indicate that, the average CO_2 efflux from the forest floor, as measured during the experiment (5.09 µmol m^{-2} s^{-1}), is lower than total ecosystem respiration, estimated from EC data (6.25 µmol m^{-2} s^{-1}). Spatial variability of soil CO_2 efflux (Rs) can be explained by litter thickness (Lt) variability, however the tree root respiration can be considered valuable part CO2 emission from the forest bottom.



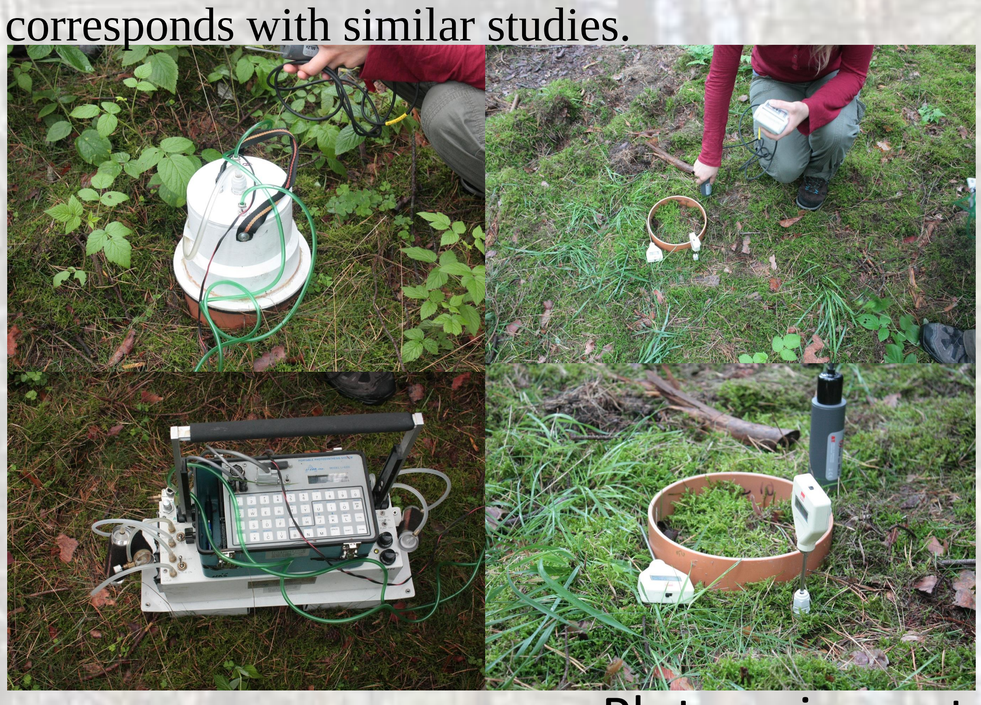
Tuczno site

Site description

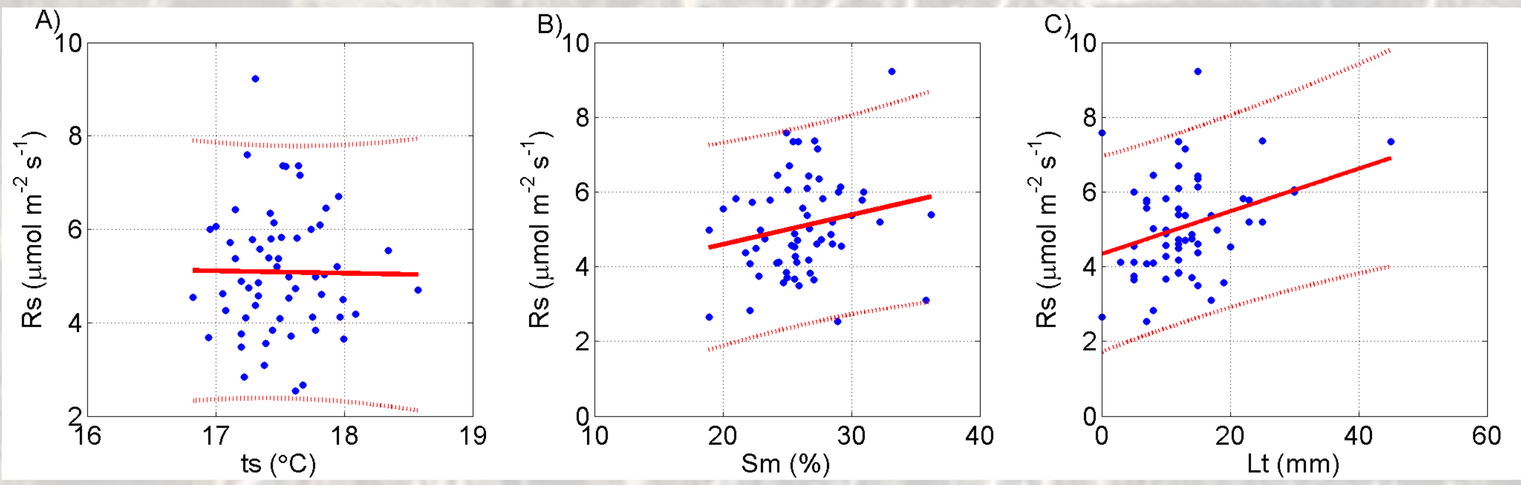
Tuczno forest is a 60 years old Scots pine stand that is located in North-West part of Poland. The studied forest consists of 60-year-old Scots pine (*Pinus sylvestris* L.) and 71-year-old Birch (*Betula pendula* ROTH), which cover respectively 99% and 1% of the investigated area. The annual average precipitation and air temperature recorded at this site are 570 mm and 7.6 °C, respectively. These meteorological characteristics are similar to average values observed in Poland, where precipitation is 600 mm and air temperature is 8.5 °C. The growing season is approximately 220 days.

Conclusion

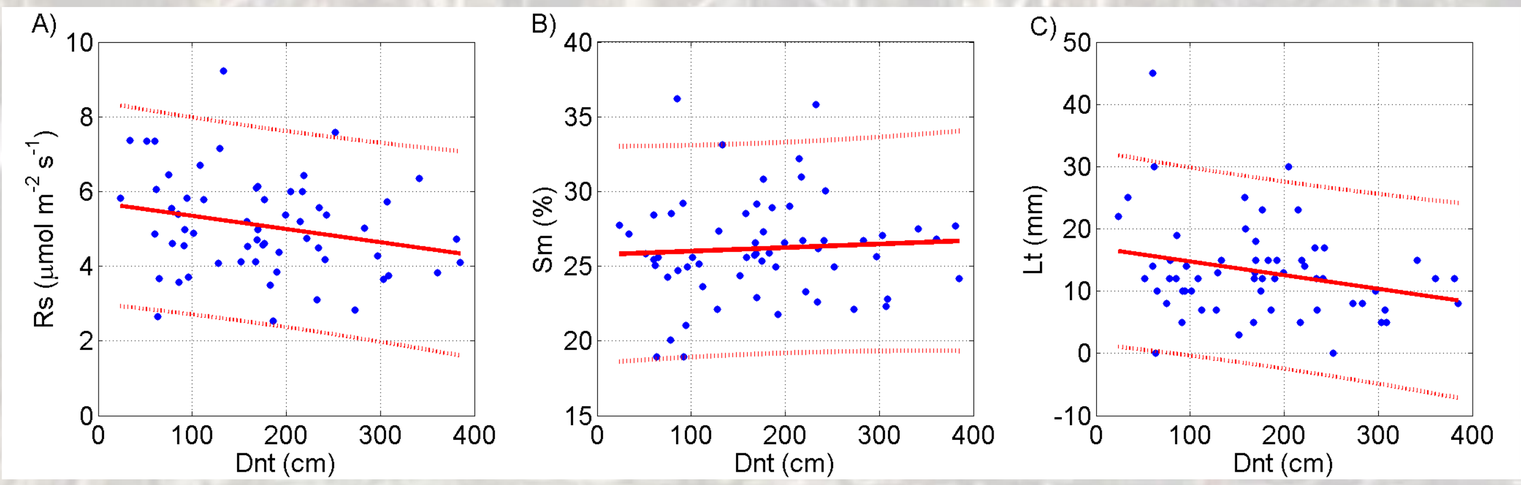
The soil efflux seemed to be independent of soil temperature (ts) but the range of observed ts during the experiment was very narrow thus soil moisture and litter thickness seem to determine soil efflux more in such conditions. The spatial variability of soil CO_2 emission seemed to be depended on litter thickness (Lt) that is basis for heterotrophic respiration, however autotrophic respiration of tree's roots can be also the explanation due to weak dependencies between distance to the nearest tree and Lt. The soil CO_2 efflux was 78% of total ecosystem respiration and this result well corresponds with similar studies.



Plot equipment



The Soil efflux measured with chamber (Rs) in relation to A - soil temperature (ts); B – soil moisture (Sm); C – litter thickness (Lt). Solid line – regression line, dotted lines - 95% confidence bounds.



The Soil efflux measured with chamber (Rs), soil moisture (Sm) and litter thickness (Lt) in relation to distance to the nearest tree (Dnt). Solid line – regression line, dotted lines – 95% confidence bounds