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Effect of elevated atmospheric CO_2 concentration on soil CO_2 and N_2O effluxes in a loess grassland

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Increasing atmospheric CO_2 concentration proved to be the primary factor causing global climate change. Exposition systems to study the response to increasing CO_2 levels by the terrestrial vegetation include the open top chamber (OTC) exposition system, also used in this study.

Response of biomass growth and ecophysiological variables (e.g. emission of greenhouse gases (CO_2, N_2O) from the soil) to elevated atmospheric CO_2 concentration were investigated in the OTC station, located in the Botanical Garden of the Szent István University, Gödöllő, Hungary. Loess grassland (*Salvio nemorosae – Festucetum rupicolae*) monoliths were studied in OTCs with target air CO_2 concentration of 600 mikromol.mol^{-1} in 3 chambers. The chamber-effect (shade effect of the side of the chambers) was measured in 3 control chambers under present CO_2 level. This management was compared to 3 free air parcels under the natural conditions. Changes of soil temperature and soil water content were recorded in each treatment, while PAR, air temperature, precipitation, wind velocity and humidity were measured by a micrometeorological station. Plant biomass was cut down to 5 cm height once a year. Leaf area index (LAI) was estimated weekly from ceptometer measurements, soil CO_2 and N_2O effluxes were also measured weekly during the growing period and less frequently during the rest of the year.

Soil water content in the upper 30 cm of the soil was lower in the chambers by 3 % (v/v) in average than in the field plots. Soil temperature in the chambers at 3 cm depth was 1.5^{o}C lower than in the free air parcels probably due to the shading effect of the larger biomass in the chambers. In the chambers (both the high CO_2 and control ones) biomass values (536.59 $\pm$222.43 gm^{-2}) were higher than in the free parcels (315.67 $\pm$73.36 gm^{-2}). Average LAI was also higher (3.07 $\pm$ 2.78) in the chambers than in the free air treatment (2.08 $\pm$ 1.95).

Soil respiration values in the high CO_2 treatment was higher in the high CO_2 chambers than in the control ones by 12% (P=0.03) during the 3 year of the study.

There was no significant differences between the above ground biomass values in the elevated CO_2 OTC and control OTC in 2010-2012, though the values were higher in the high CO_2 treatment in each year by 5% in average. LAI also did not differ, in the elevated CO_2 OTC its value was 3.07 ($\pm$2.37), and in the control OTC was 3.06 ($\pm$2.39) in average. N_2O emission was monitored between 2007-2012. There was no demonstrable change in N_2O emission of the soil due to the elevated CO_2 treatment.