CLIMAITE – a three factor climate change ecosystem manipulation experiment

N. Mikkelsen, Teis; Beier, Claus; Albert, Kristian; Ro-Poulsen, Helge

Published in:
Geophysical Research Abstracts

Publication date:
2007

Document version
Publisher's PDF, also known as Version of record

CLIMAITE – a three factor climate change ecosystem manipulation experiment

Mikkelsen TN[1], Beier C[1], Albert K[2], Ro-Poulsen H[2]

(1) Risoe National Laboratory Biosystems Department Technical University of Denmark, POB 49 Frederiksborgvej 399, Roskilde, 4000, Denmark, teis.mikkelsen@risoe.dk
(2) University of Copenhagen, Institute of Biology, Øster Farimagsgade 2D, Copenhagen, 1352 K, Denmark

The Danish multi factorial climate change effects on vegetation experiment (Climaite) have now been conducted for two years on semi-natural grassland. The day time [CO2], night time temperature and precipitation (drought) have been altered, according to a regional climate change model for the year 2075, in a full factorial split plot design. The manipulated area for each treatment is 7 m2 and it is replicated 6 times. The CO2 and temperature treatments have been conducted continuously except for periods with snow cover. The CO2 is enhanced to 510 ppm via a FACE system based on concentrated CO2 released upwind under pressure. The control of the [CO2] varies with wind speed and irradiation, but during 50 percent of the fumigation period the target concentration was kept within +/-5 percent. The temperature treatment is conducted via infrared reflective curtains covering the plots during night time, and the warming of plants and soil depends of the day irradiation, night time wind speed and factors related to seasonality. In general, the air temperature is increased during night time with 1-2 C° and negligible during the day. The soil temperature in 5 cm depth is enhanced to 0.3 – 0.6 C° during night and day. The artificial summer droughts lasted about one month and differences in soil water content were developed over time. By the end of the treatment the èv content in the soil was as low as 0.06 m3 m-3 compared to 0.20 m3 m-3 in the control. Numerous physical and biological parameters in the grassland ecosystem have been measured and several are responding to the changed environment. After 9 months of exposure enhanced [CO2] stimulated the net photosynthesis (based on dry weight) in both of the domination plant species *Calluna vulgaris* and *Deschampsia flexuosa*. When the plants were exposed to short term saturated [CO2] during gas-exchange measurements the long term CO2 treated plants also had the highest photosynthesis rate, meaning that the plants were not physiological down regulated. *Calluna vulgaris* exposed to both enhanced [CO2] and temperature in combination with drought showed a lowered photosynthesis during short term saturated [CO2] gas-exchange measurements. After one and a half year of manipulation the xylem water potential in the plants were measured during drought treatment. Drought treatment generally decreased the xylem water potential, and the enhanced [CO2] diminished the drought effect for both of the species except for Calluna exposed to all treatments in combination, here the xylem water potential dropped to the lowest level measured.