

Geophysical Research Abstracts,
Vol. 10, EGU2008-A-07931, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-07931
EGU General Assembly 2008
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CLIMAITE – a three factor climate change ecosystem manipulation experiment.

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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 ev 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 gasexchange 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] gasexchange 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 treatment.