



CLIMGRASS - AN EXPERIMENT TO QUANTIFY AND UNDERSTAND EFFECTS OF WARMING, ELEVATED CO₂ AND SUMMER DROUGHT ON PRODUCTIVITY AND BIOGEOCHEMICAL PROCESSES IN PERMANENT GRASSLAND

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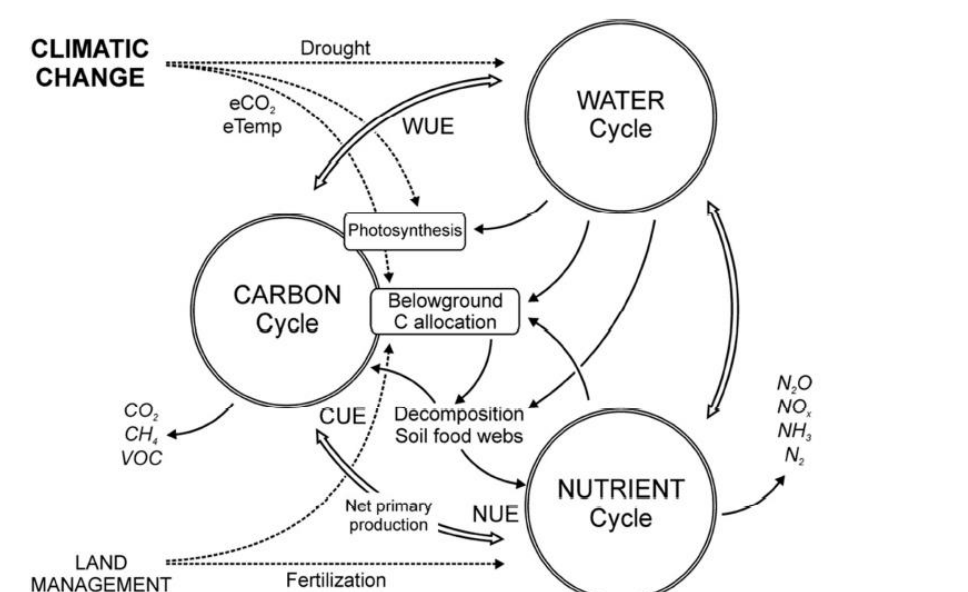
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RESEARCH SCOPE

Climate projections suggest a doubling of atmospheric CO₂ concentrations to more than 700 ppm, an increase of the Earth's surface temperature by 1.5 – 6.4°C and an enhanced frequency and intensity of extreme weather events by the end of the 21st century (IPCC 2007, Christensen et al. 2007). While there is already considerable knowledge on the responses of plants and ecosystems to individual climate factors, the combined and interactive effects of multiple climate drivers on ecosystem processes in real world ecosystems are much less known (e.g. Luo et al. 2011).

CLIMGRASS EXPERIMENT

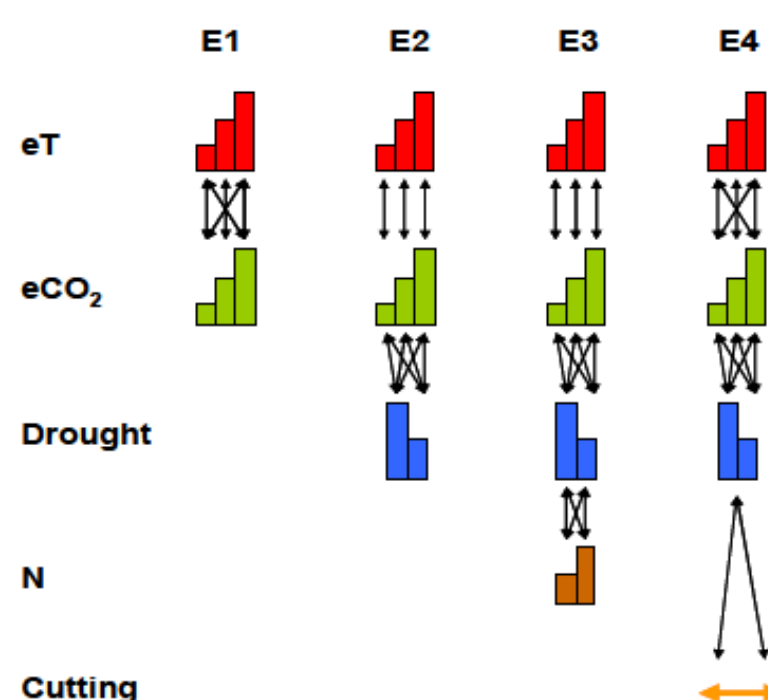
The overarching aim of the ClimGrass experiment is to quantify and understand individual and combined effects of warming, elevated CO₂ and weather extremes on a hierarchy of biogeochemical processes in a permanent upland grassland, accounting for interactions between carbon, nutrient and water cycles and the central role of biota governing these processes.



Conceptual outline of major processes and their interactions as addressed by ClimGrass



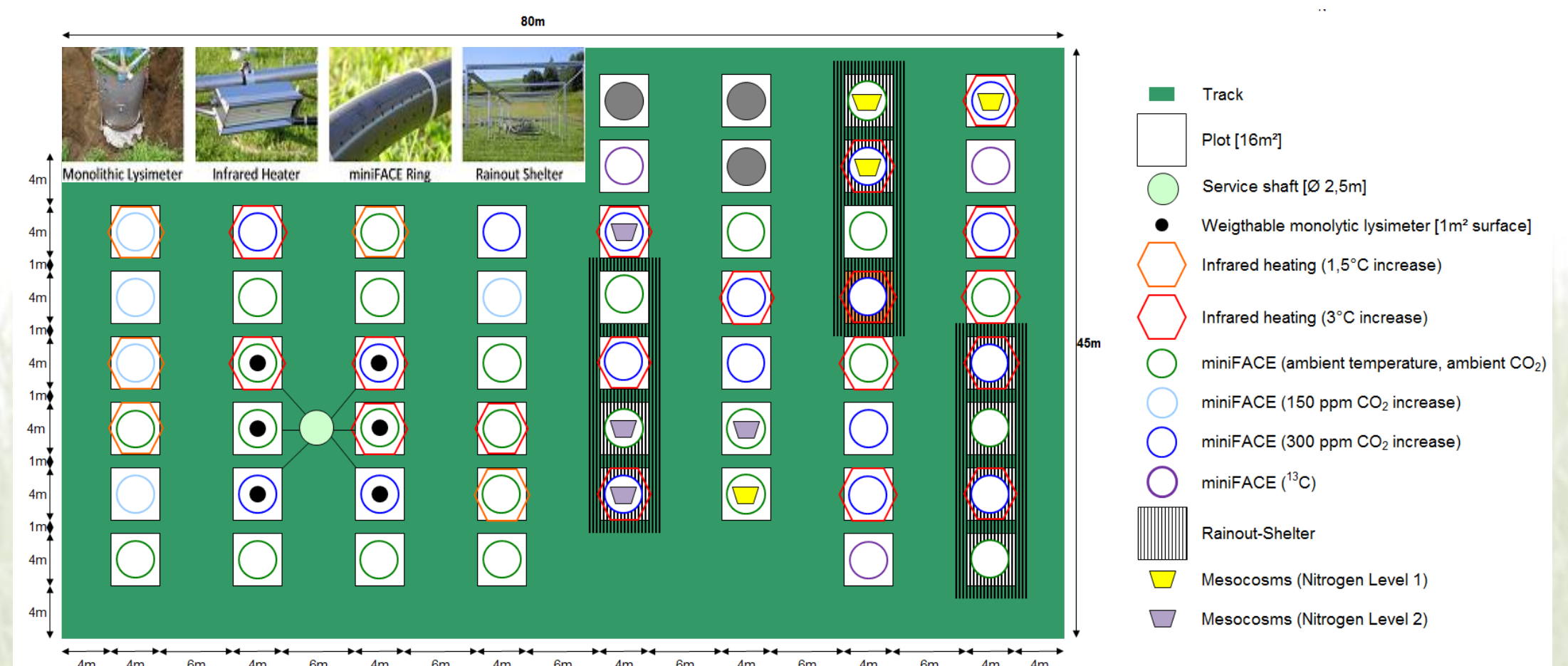
Overview of the ClimGrass experiment



Experimental treatments foreseen in experiments E1-E4: eT (warming): ambient, +1.5, +3°C, elevated CO₂: ambient, +150, +300 ppm; control vs. summer drought, N: no fertilization vs. fertilization, altered cutting regime

ClimGrass pursues a multifactorial experimental approach and will focus on four multifactor sub-experiments: Experiment 1 (E1) will test effects of warming and elevated CO₂ based on a range of combinations of air temperature and CO₂ on 24 plots. Experiment 2 (E2) will test effects of extreme weather events (summer drought /heatwave) under current and a future climate scenario. Experiment 3 (E3) will test effects of nutrient availability on ecosystem response to warming, elevated CO₂ and drought, exposing 48 in situ grassland monoliths to the scenario treatments of E2, and testing two fertility levels. Experiment 4 (E4) address the issue of how grassland management affects ecosystem responses to climate change.

The ClimGrass experiment is established on permanent grassland and is located at AREC Raumberg-Gumpenstein, Irdning, Austria. The facility was installed between 2010 and 2013, has been repeatedly tested and is fully operational. ClimGrass is a unique facility that enables research in the field of process-oriented terrestrial ecosystem research with the high degree of synergy needed to advance the understanding of the mechanisms driving ecosystem responses to global change.



Experimental design and equipment used in the ClimGrass experiment

References:

Christensen JH, Christensen OB (2007) A summary of the PRUDENCE model projections of changes in European climate by the end of this century. *Climatic Change* 81: 7-30.
IPCC (2007) *Climate Change: The Physical Science Basis. 4th Assessment Report of the Intergovernmental Panel on Climate Change* (eds. Solomon S., Qin D., Manning M. et al.) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.
Luo YQ, Melillo J, Niu SL, Beier C, Clark JS, Classen AT, Davidson E, Dukes JS, Evans RD, Field CB, Czimczik CI, Keller M, Kimball BA, Kueppers LM, Norby RJ, Pelini SL, Pendall E, Rastetter E, Six J, Smith M, Tjoelker MG, Torn MS (2011) Coordinated approaches to quantify long-term ecosystem dynamics in response to global change. *Global Change Biology* 17: 843-854.

