REDUCED TRANSPIRATION IN FOREST TREES UNDER ELEVATED CO_2: FACT OR FAIRYTALE?

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INTRODUCTION

- Under elevated CO_2 (540ppm), plants generally transpire less through partial stomatal closure
- In grassland, up to 40% watersavings have been found
- If such a water saving effect is present in forest ecosystems, this has a major effect on climate: the atmosphere receives less water and soil moisture increases, leading to unkown feedback effects
- To date, no data exist on adult trees in a natural environment, we present first results

METHODS

- Three common deciduous forest tree species were investigated at the Swiss Canopy Crane site (see background picture): *Quercus petraea* (oak) *Fagus sylvatica* (beech) and *Carpinus betulus* (hornbeam)
- Five different methods were used to quantify transpiration in control and CO_2 treated trees (see hexagon)

SAPFLOW

SOIL MOISTURE

THERMAL IMAGING

WATER POTENTIAL

STOMATAL CONDUCTANCE

RESULTS

- Only relative sap flow data indicate reduced transpiration in CO_2 – treated trees
- Stomatal conductance, soil moisture, predawn water potential and leaf temperature (preliminary data only) are not or little affected by elevated CO_2
- Generally canopy level analysis (thermal imaging, sap flow) are more useful to overcome the low signal / noise ratio

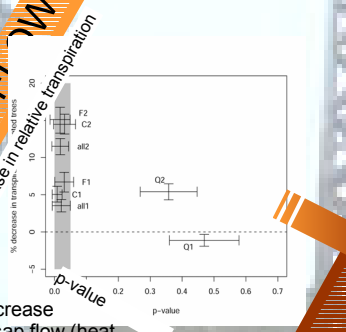

Fig 1. Decrease in relative sap flow (heat flow sensors) of *Quercus* (Q), *Fagus* (F) and *Carpinus* (C) during June (1) and August (2) plotted against the bootstrapped error probability (grey bar <5%). C and F are s (mean value +/- se).

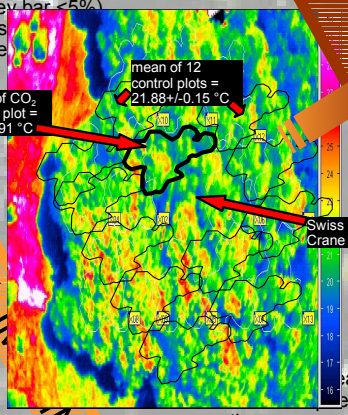

Fig 2. eaves e less, they are warmer. Thermal scan of the 12 CO_2 treated area on a sunny day in July 2004. The expected difference of ca. 0.2°C is not apparent

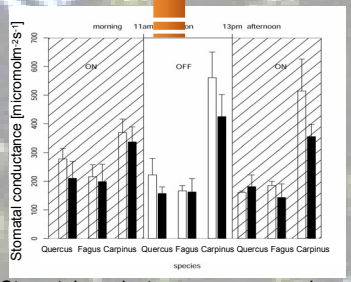

Fig 3. Stomatal conductance on a sunny day with the CO_2 supply switched off during the noon measurements. There are no significant differences (n=3, mean +/- se).

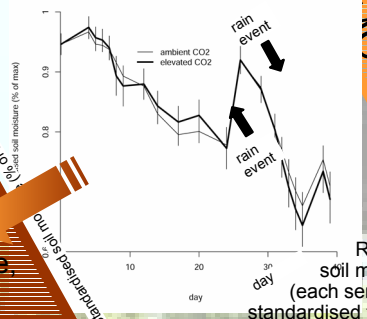

Fig 5. Relative soil moisture (each sensor standardised to its maximum) in the control and treated plot during a dry period with two rain events. There is no significant difference between the plots (n=15, mean+/- se).

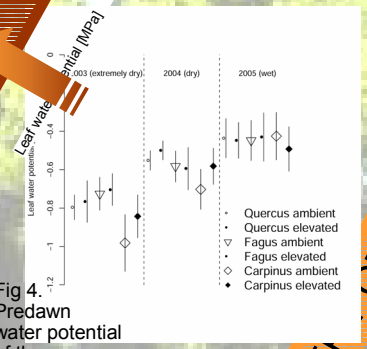

Fig 4. Predawn water potential of three years (multiple measurements per year). There are no significant differences between species and treatment (except 2003, slight treatment effect, n=3, mean+/- se).

CONCLUSIONS

- Water saving effects under elevated CO_2 are not as pronounced in forest trees as they are in grassland, if present at all
- Initial effects in such coupled systems might be mitigated by atmospheric feedbacks, with no or little net effect
- Whole canopy approaches are preferred over leaf level experiments in order to increase signal/noise ratio