



Macro- and micro-morphological reactions to low soil water availability in the foliage of Scots pine

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Plan

- Objectives and Research Questions
- Data and Measurements
- Insights on Results
- Collaborations and Perspectives

Link: http://www.wsl.ch/fe/walddynamik/projekte/H2Oreactio/index_EN

Objectives and Research Questions

Objectives

- To assess the structural responses within foliage
- To evaluate the morphological plasticity at needle, tissue and cell level
- To relate changes in needles to prevailing environmental constraints

Research questions

- In response to the irrigation treatment:
 - How has the foliage responded structurally?
 - Have the needles reduced their xeromorphy?
 - Within control trees:
 - Is any indication of drought stress to be found?
- => Which of drought stress or other environmental constraint is the main driver of structural changes in foliage of pines at Pfywald?

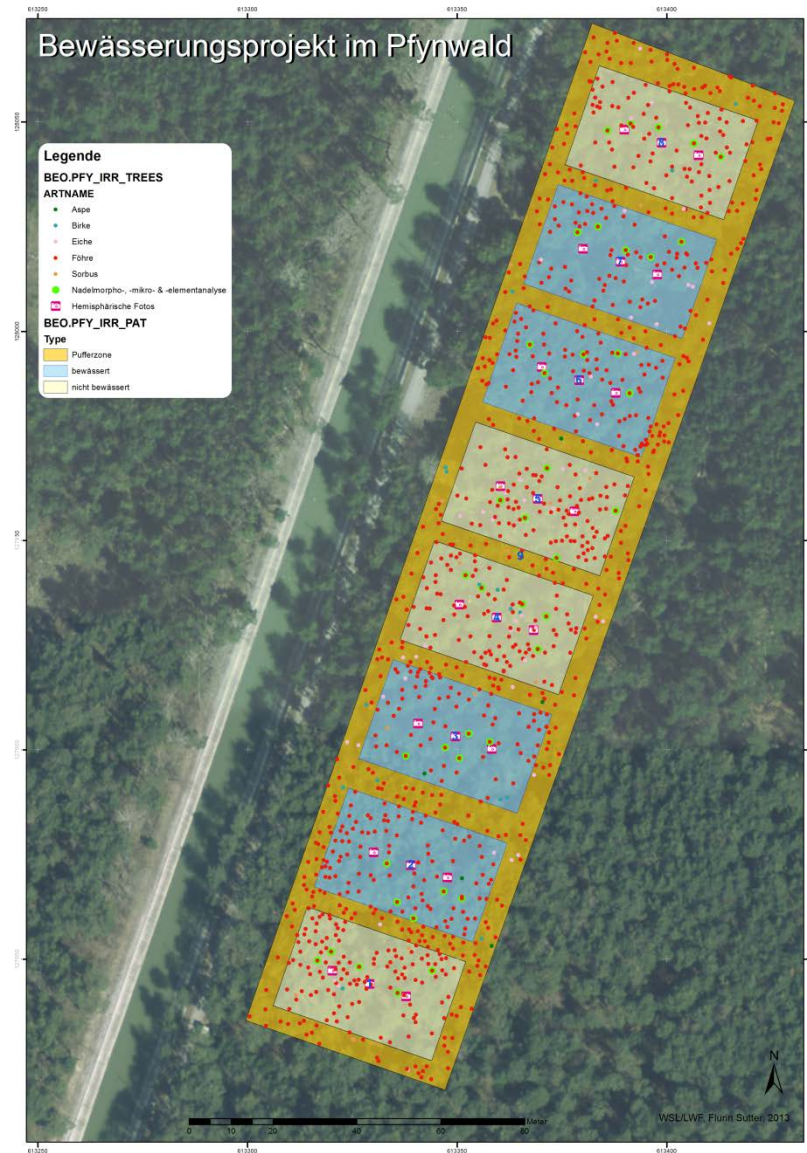
Data and Measurements

Material

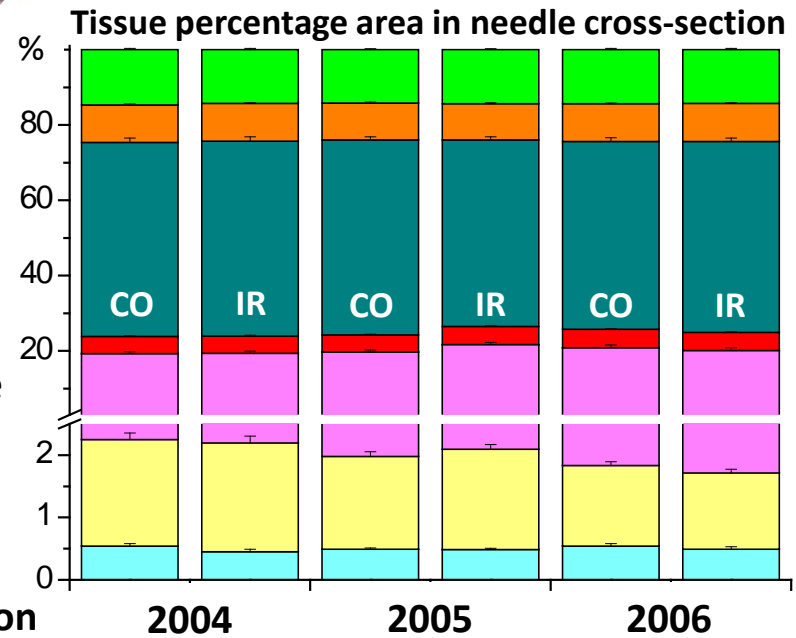
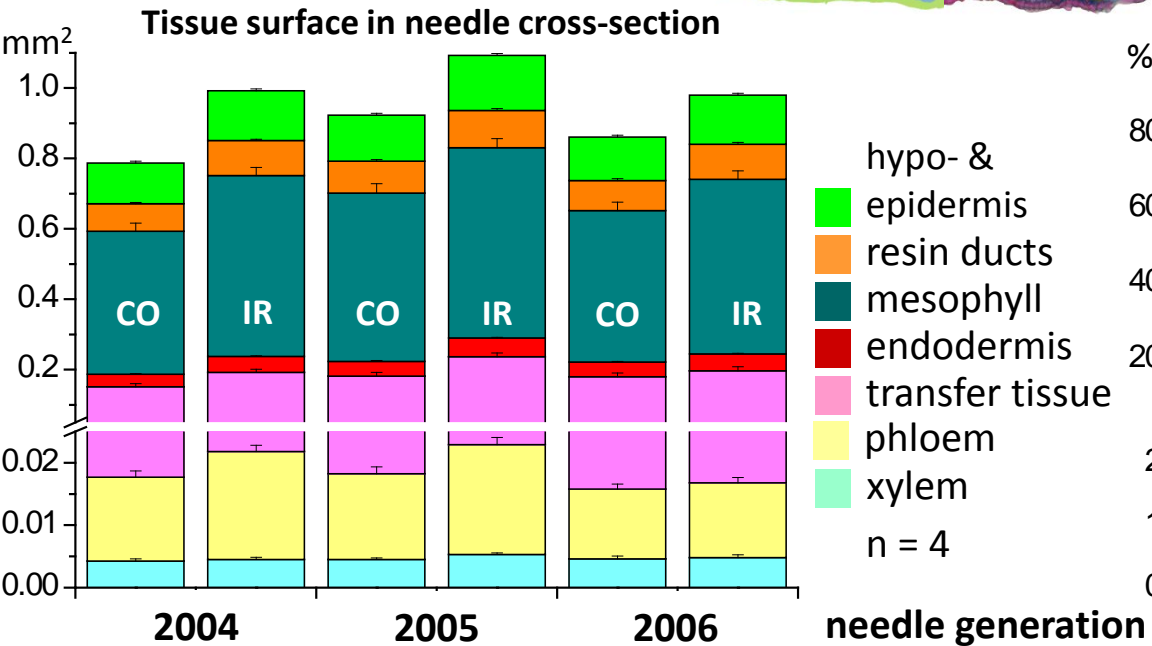
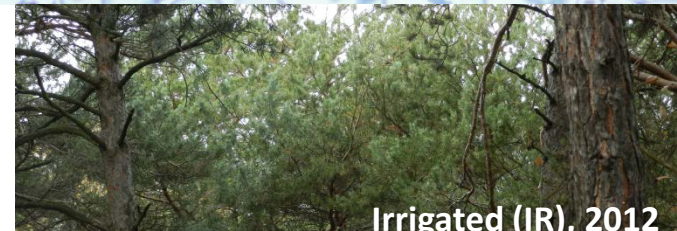
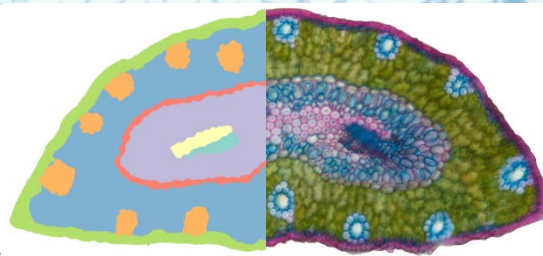
- two branch harvest (2006 and 2012)
- 2 treatments x 4 plots x 5 trees = 40 samples
- Needle data: 3 generations analyzed (2004-2006; 2010-2012)
- Male flowers (occurrence) and female cone data (occurrence & DW of current (C) and C+1 cones)

Measurements

- Branch and needle morphology
- Male flowers and female cone frequency and biomass
- Needle histology (2004-2006 needles from the first harvest)
- Conducting phloem and sieve cell size (2004-2006 needles from the first harvest)



Insights on results



Rovina, C. 2013. Master thesis. ETHZ

Conclusion

- Except xylem, the surface area of all tissues in needle cross-sections was significantly increased by the irrigation treatment.
- no change in needle xeromorphic traits was observed suggesting that water shortage is limiting the growth of control trees via carbon shortage

=> Competition, rather than drought stress may trigger Scots pine decline at Pfywald

Collaborations and Perspectives

Collaborations

- Patrick Schleppi (hemispherical pictures and element analysis)

Perspectives

Follow-up projects: to further investigate the morphological plasticity and needle xeromorphy as a function of varying soil moisture availability and change in land use:

- Project: **“Climate and land use change in Wallis: response of Scots pine stands to undergrowth removal”** *experimental site of Salgetsch, 1 ongoing master thesis*
- Project: **“Tolerance of Scots pine to drought stress in the context of ongoing climate change”** *shelter experiment in Leuk, foreseen as a master thesis*

Collaborations in these projects:

- Patrick Schleppi (hemispherical pictures and element analysis)
- Frank Hagedorn (soil processes and Carbon cycle)
- Jean-Michel Gobat and Claire Le Bayon, Lab. Sol & Végétation, UNINE, (soil profiles, humus layer)
- Barbara Moser & collaborators of the Disturbance Ecology group (shelter experiment)