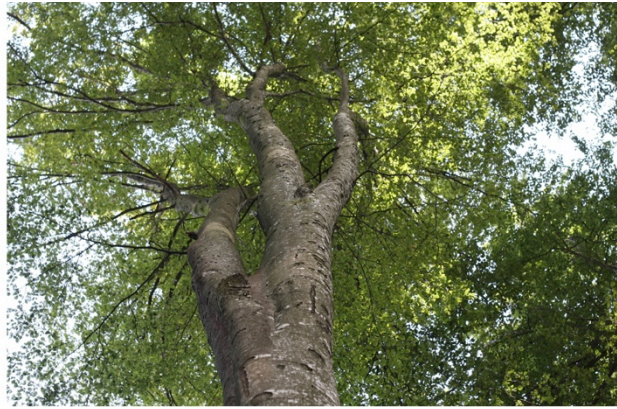




Disentangling tree water deficit and growth from dynamic stem radius changes

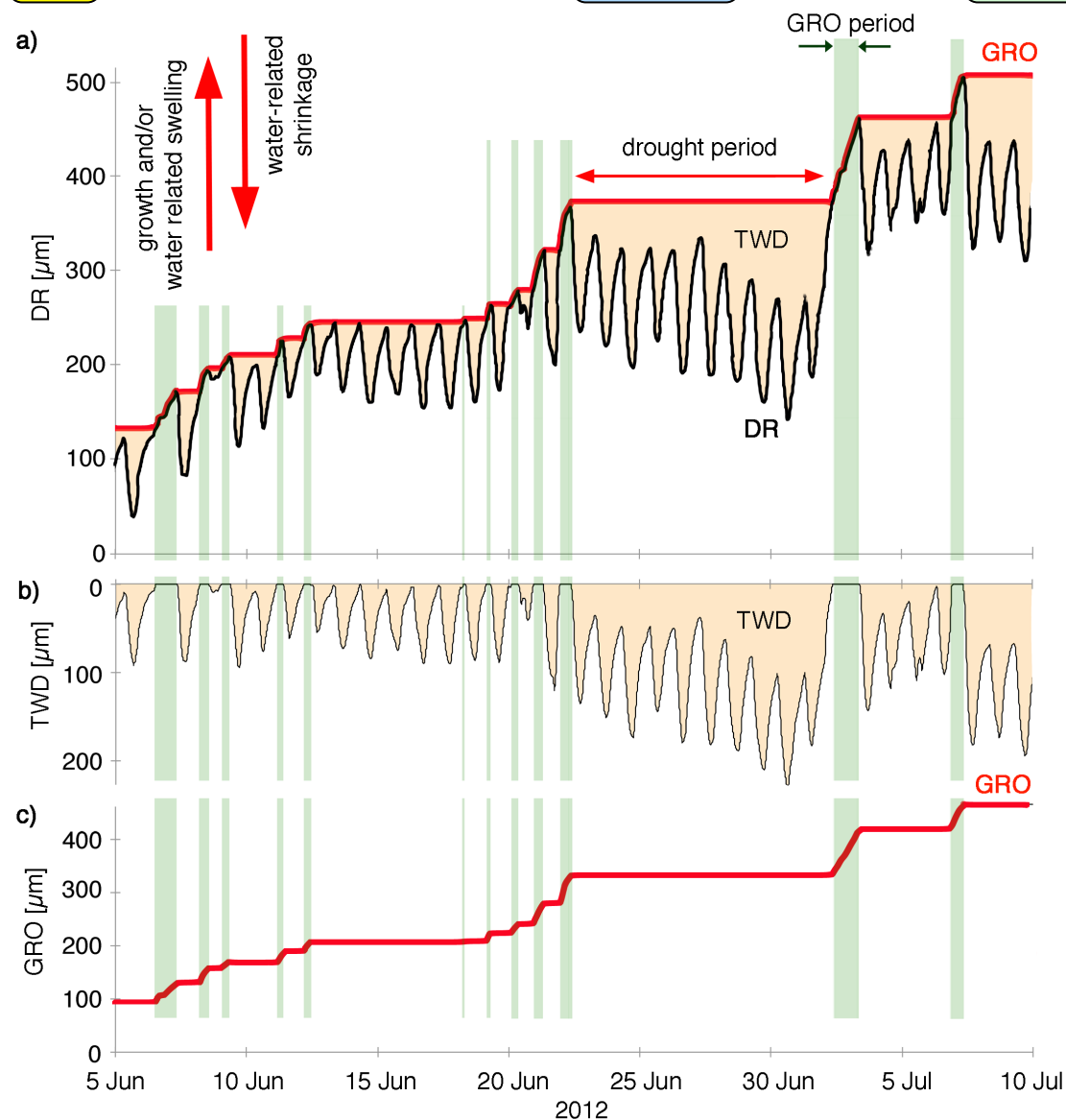
**Roman Zweifel (WSL)
Matthias Häni, Werner Eugster, Nina Buchmann (ETHZ)**

Pfynwald Workshop, WSL

6. December 2013



$$\text{DR} = \text{Tree water deficit (TWD)} + \text{growth (GRO)}$$



⇒ **TWD is the missing water of a tree to fully saturate its tissues**

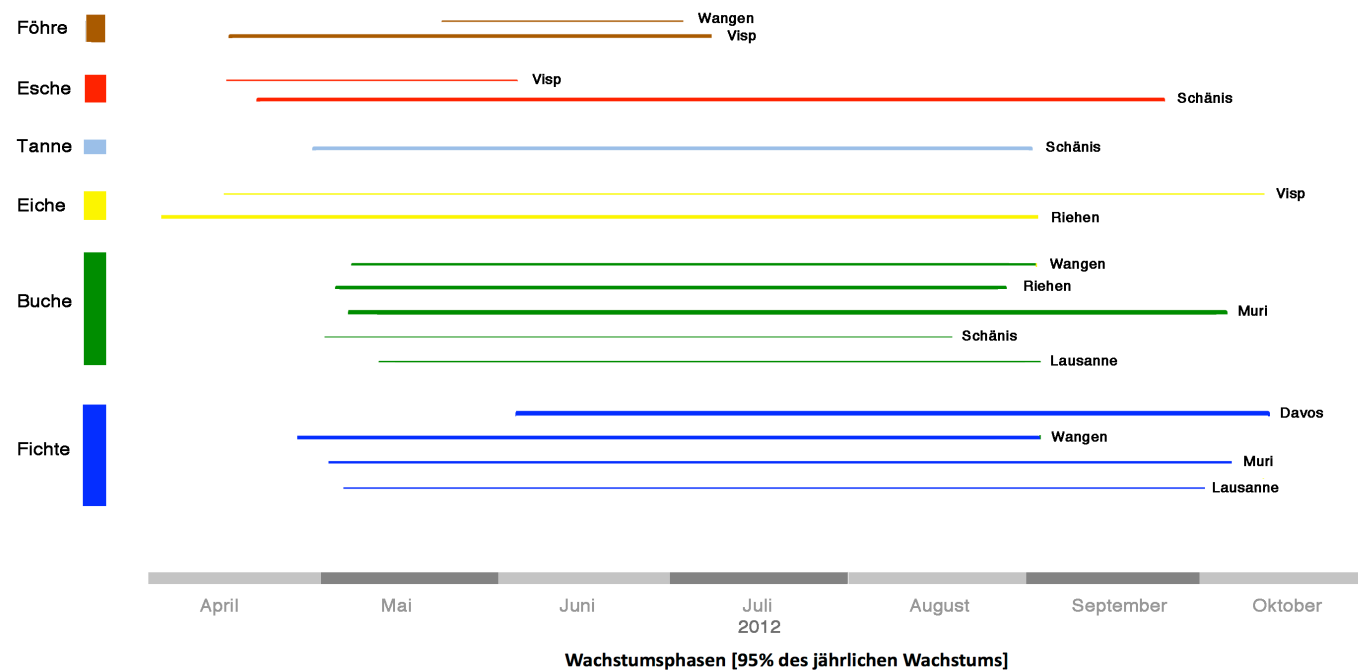
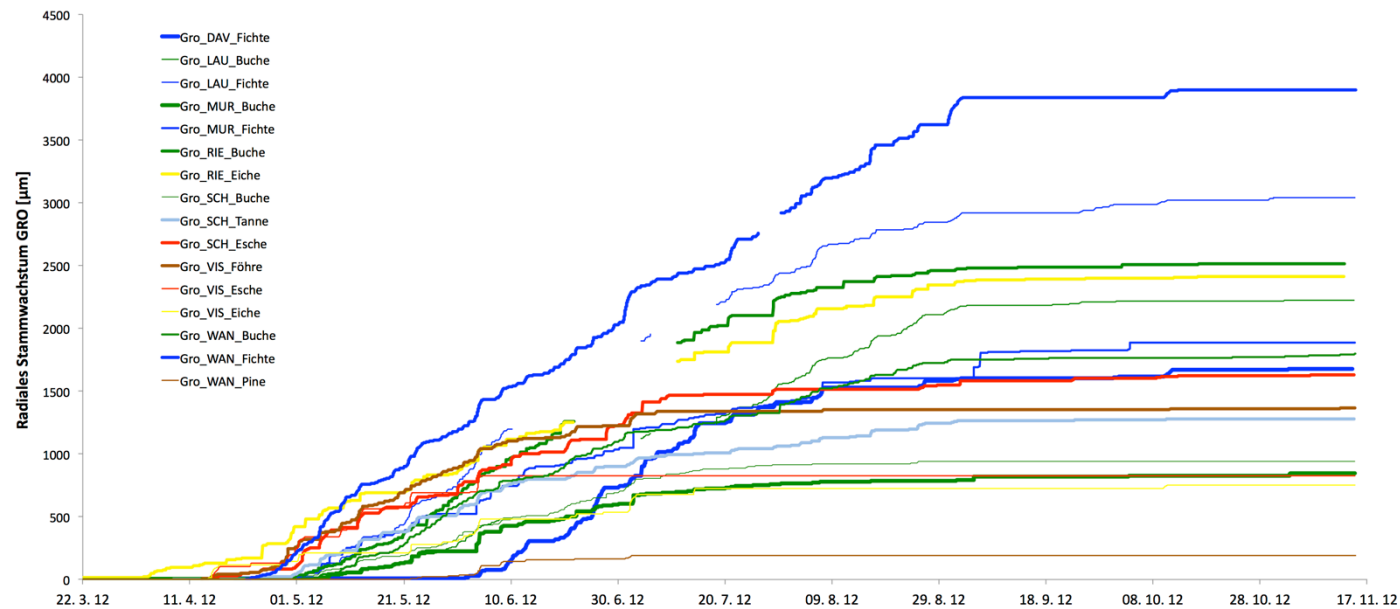
(Daudet et al. 2005, Steppe et al. 2006, 2008, Zweifel et al. 2001, 2007)

⇒ **GRO is cell division and cell expansion (wood and bark!)**

Premiss: GRO occurs only for TWD = 0 (Lockhart 1965)

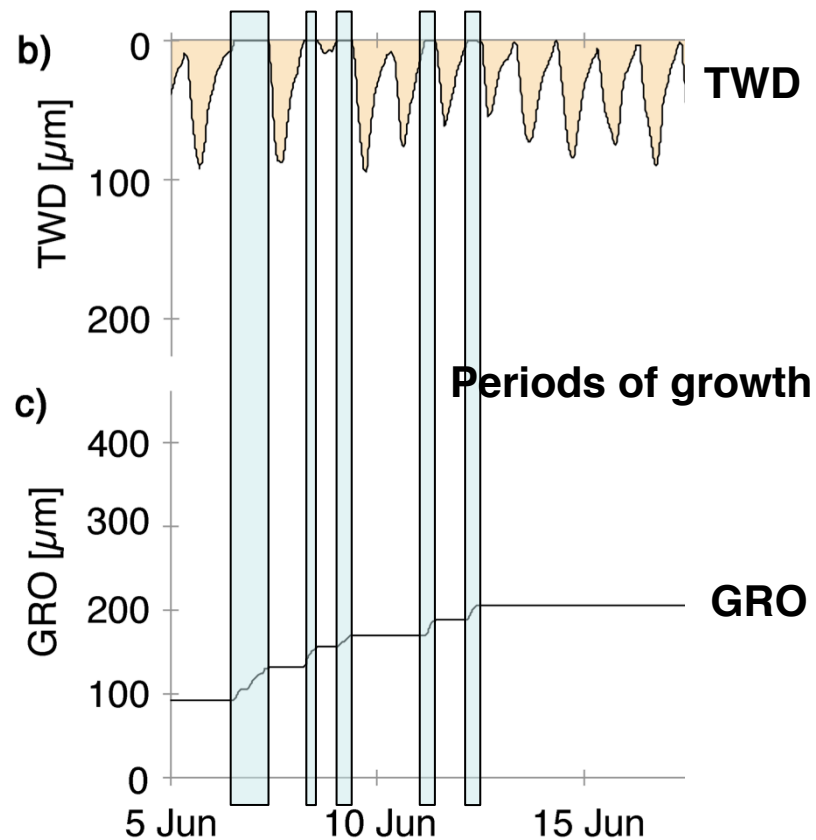
GRO

Growth pattern in Switzerland 2012

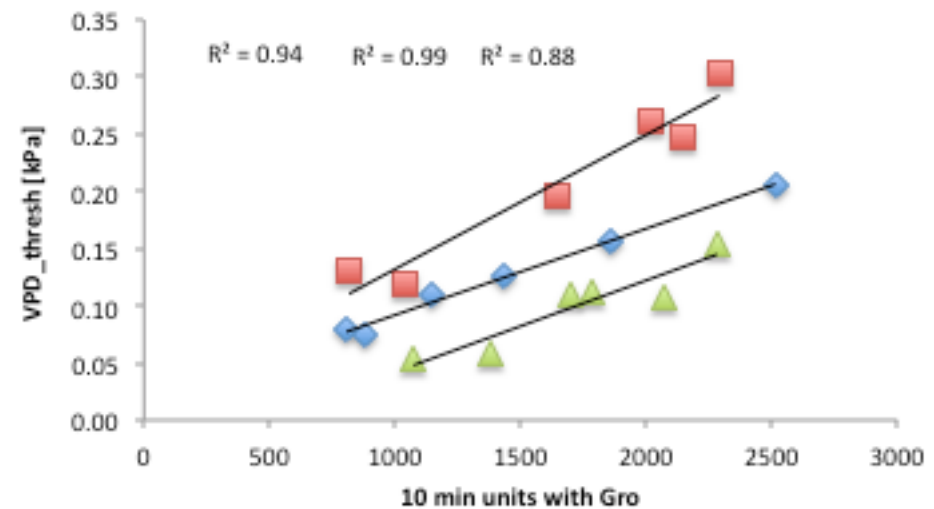


GRO

What conditions enable a tree to grow?



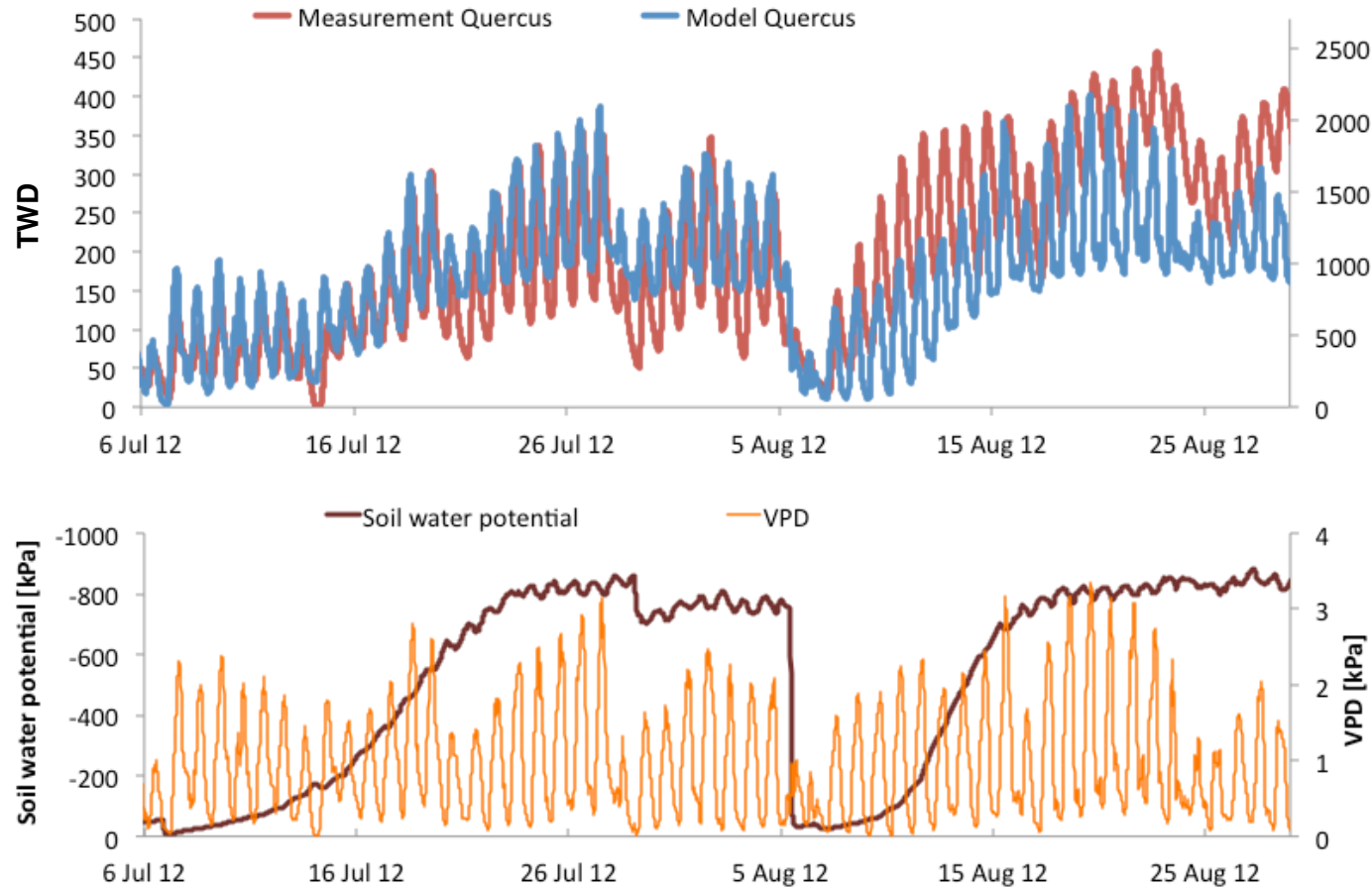
Air conditions (VPD)



⇒ The higher the VPD threshold the more GRO
(3 years, 6 Norway spruce, Davos)

TWD

What determines TWD?

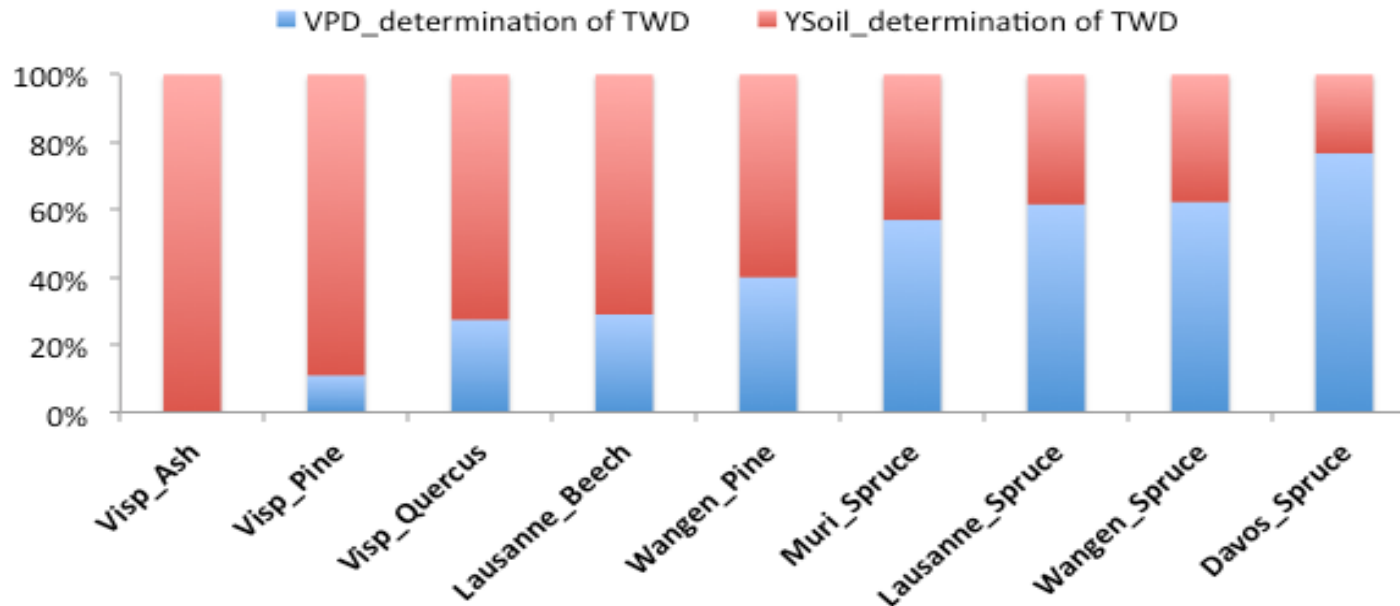


Zweifel et al. 2005, Tree Physiology



**=> mainly VPD
and soil water
potential**

What determines TWD?



← Dry site

Wet site →

- ⇒ TWD is mainly driven by soil water conditions at dry sites
- ⇒ TWD is mainly driven by evaporative demand of air at wet sites
- ⇒ Drought-tolerant species at a specific site are less determined by soil water (dry: Oak < Pine < Ash, wet: Beech < Spruce)



Chances within the Pfywald project ...

- ... -> Combine drought stress indicator of individual trees with physiological measures. Compare treatments.
- ... -> Resolve stem growth (cambial activity) patterns on a new level of temporal resolution. Compare treatments.
- ... -> Leading to new insights into carbon budgets x tree water relations.
- ... -> Upscaling of any results relatable to DR measurements to the landscape level via TreeNet.