

Radial stem growth and tree water deficit

6th Pfywald workshop



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Eidgenössische Forschungsanstalt für Wald, Schnee und Landschaft WSL, Birmensdorf

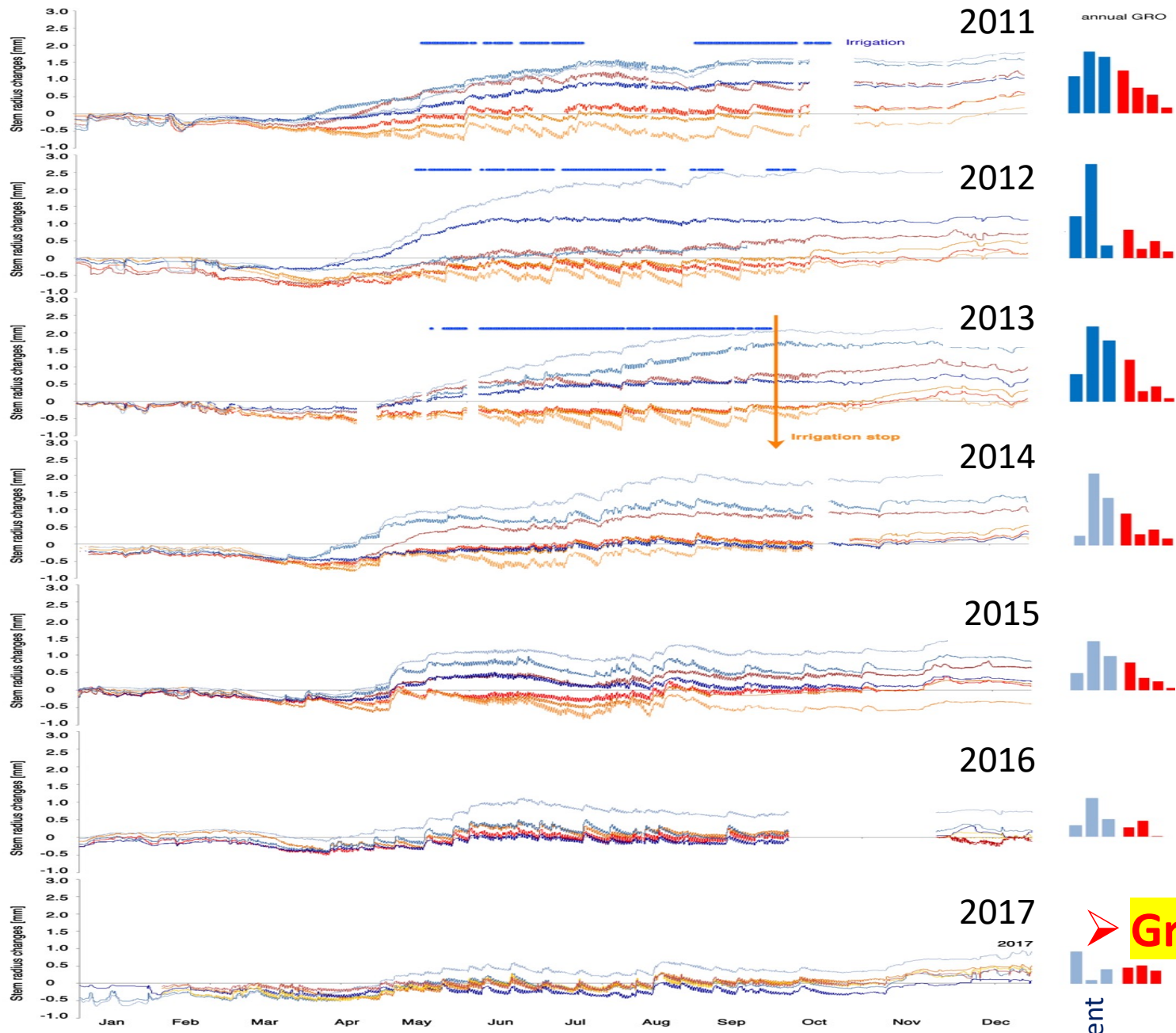
WSL, 7 March 2024

Point dendrometers ...

... a method to monitor radial stem growth and tree water relations in high temporal resolution



Radial stem increment



- Radial stem growth of stop-irrigation trees responds very slow.
- Annual growth rates of stop-irrigation trees remains above the control four three years, before returning to the level of the control

-> Growth shows a strong legacy effect.

Growth includes wood and bark!!!!



TreeNet – the biological drought and growth indicator network

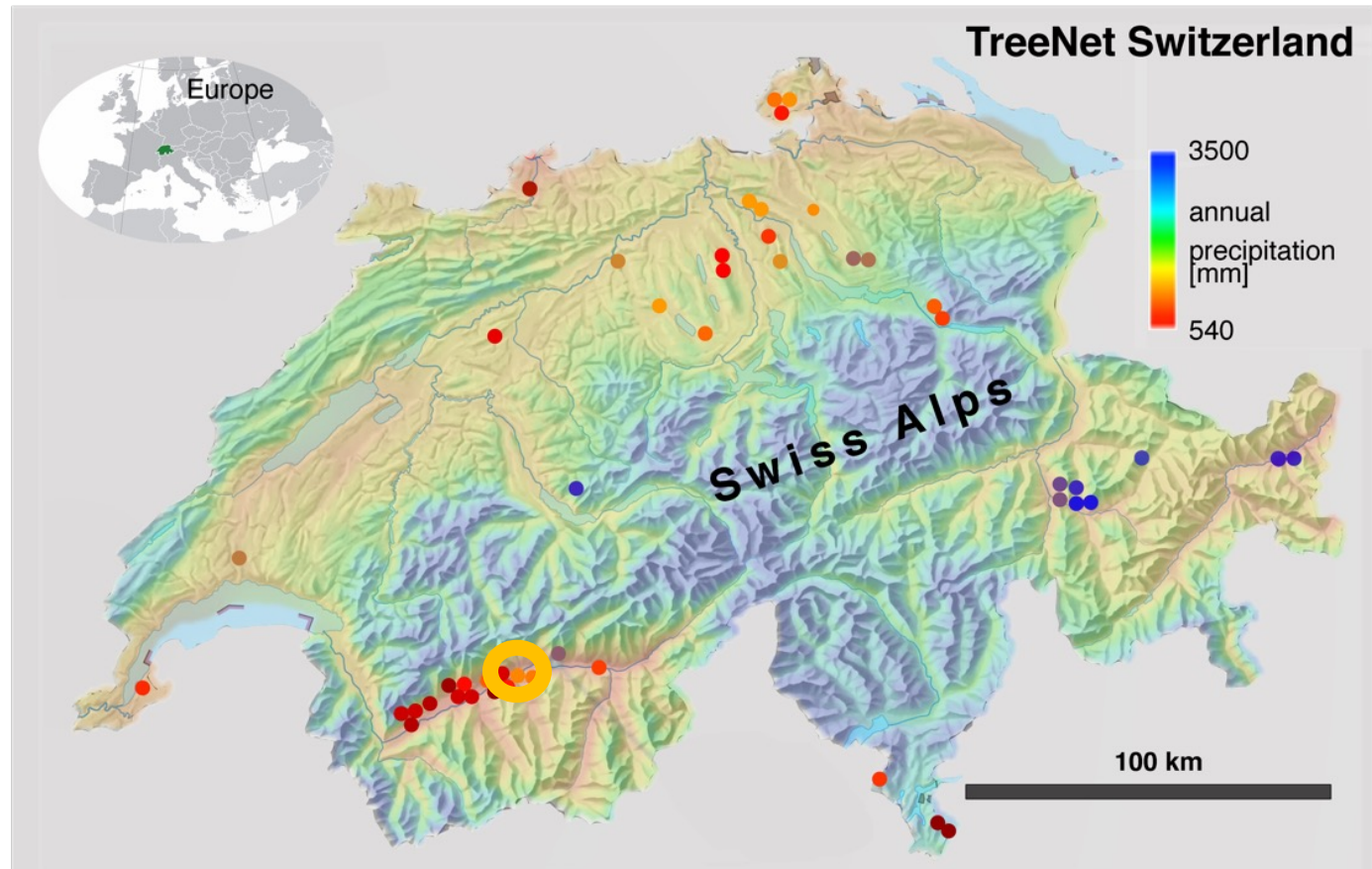


WSL
ETHZ
Uni Basel
IAP
ZHdK
BAFU

- > 500 trees
- > 10 species
- > 60 sites
- Up to 20 years of continuous data
- > 150 Mio data points (10 Min)

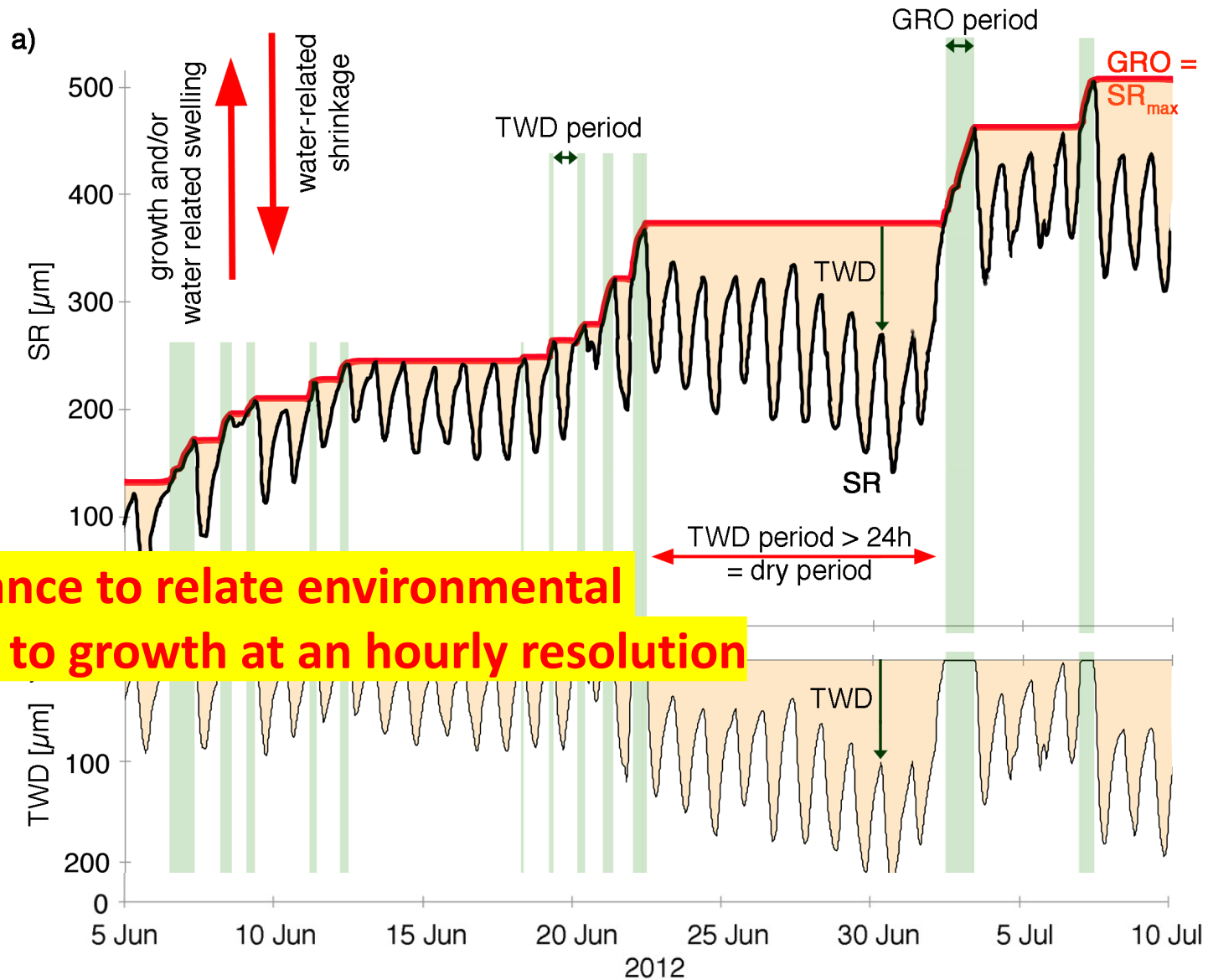
LORA technology (www.decentlab.com)

Automated data processing

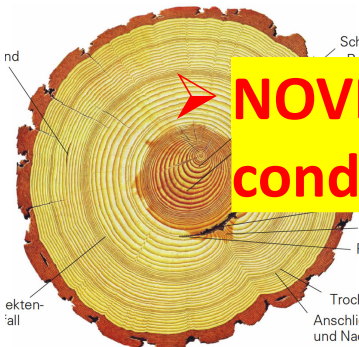




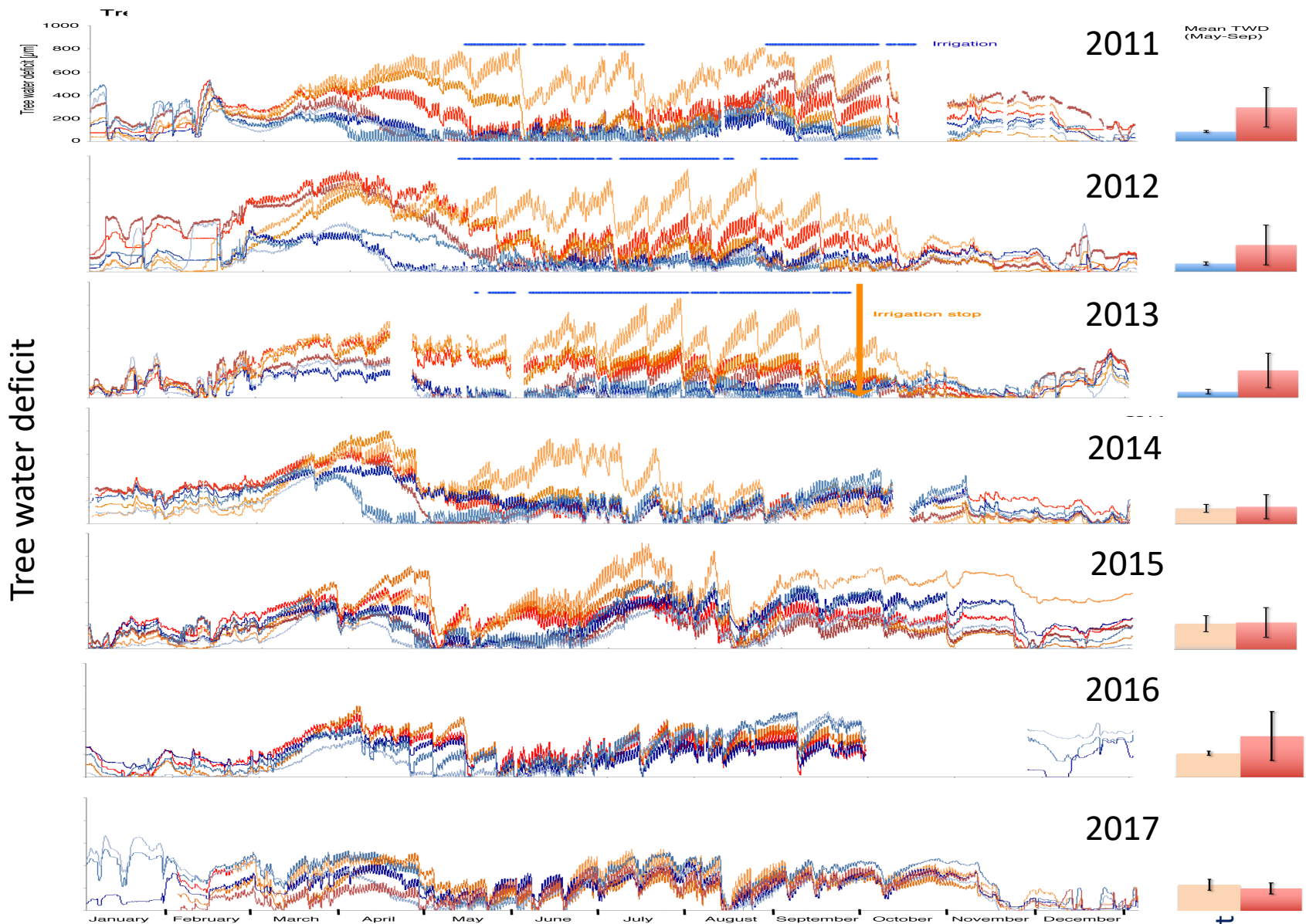
Stem radius changes and its derivatives



- Growth rates
- Timing of growth
- TWD amplitudes
- Timing of TWD
- For species
- For sites
- For regions
- Automatically recorded, temporally highly resolved data



NOVEL chance to relate environmental conditions to growth at an hourly resolution



- Tree water deficit of stop-irrigation trees returns to the level of the control after

-> Tree water relations responds quickly to the treatment change

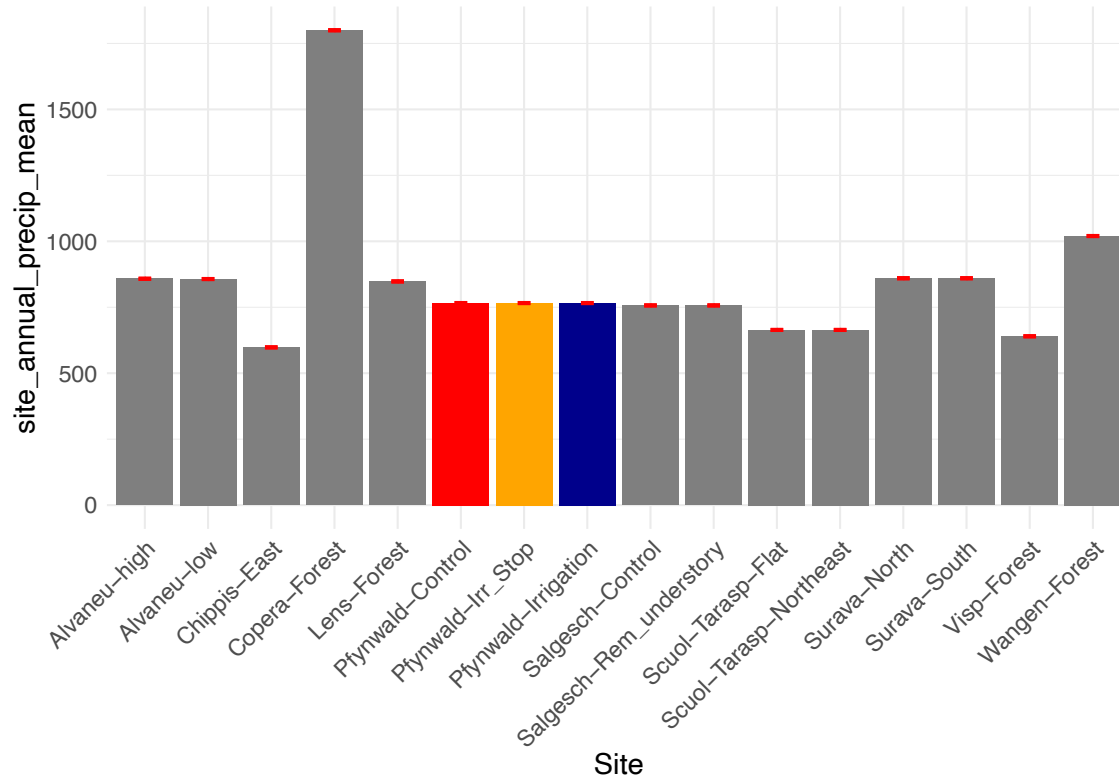
-> Sap flow breaks in and remains at a lower level than the control for four years (data not shown)

Comparison of PFY pines to other TreeNet trees

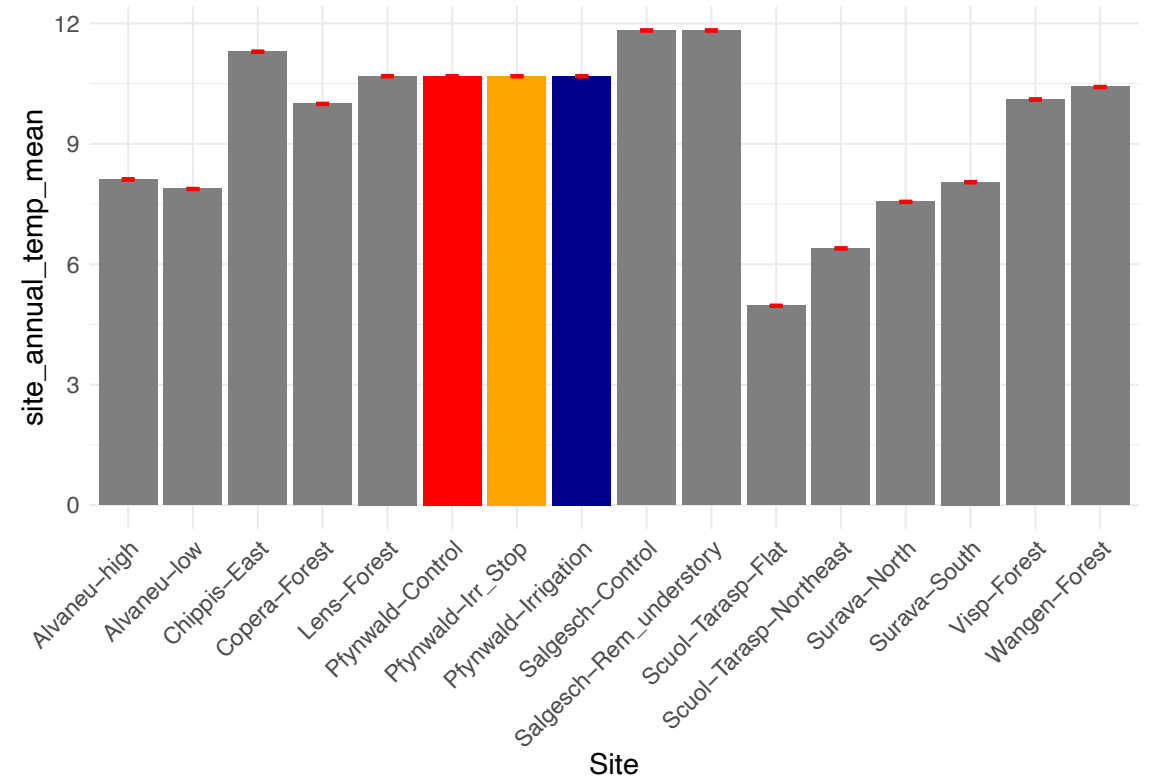


Comparison of PFY pines to other TreeNet pines

Precipitation (control) [mm per year]

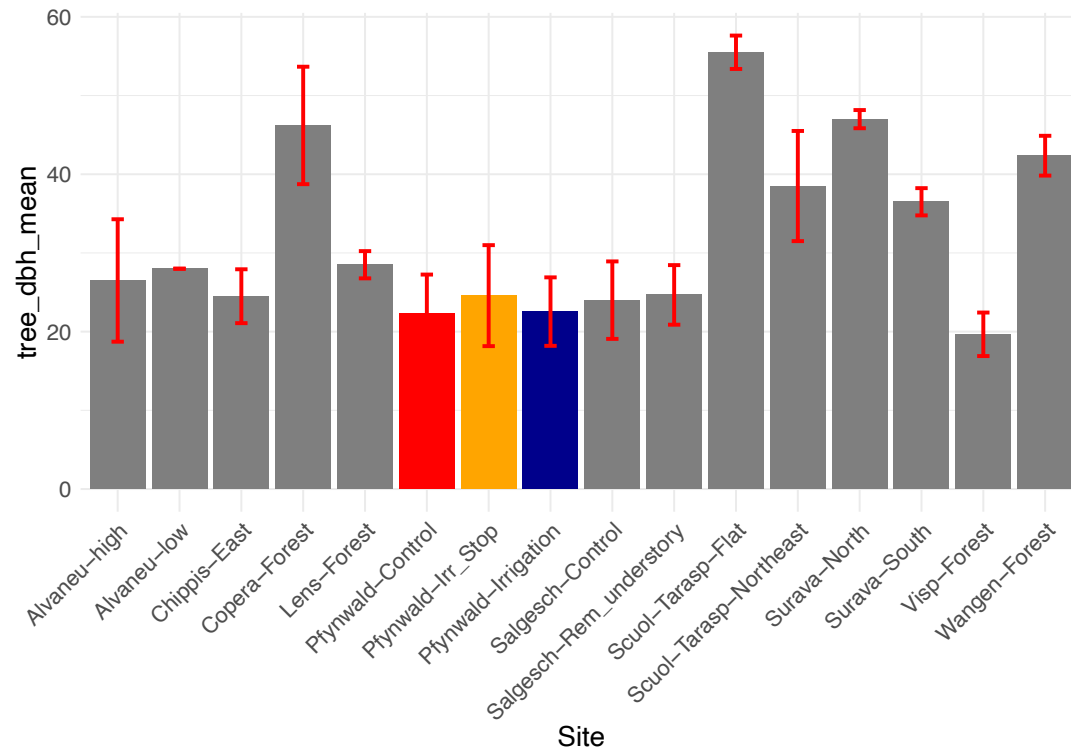


Temperature (control) [°C]

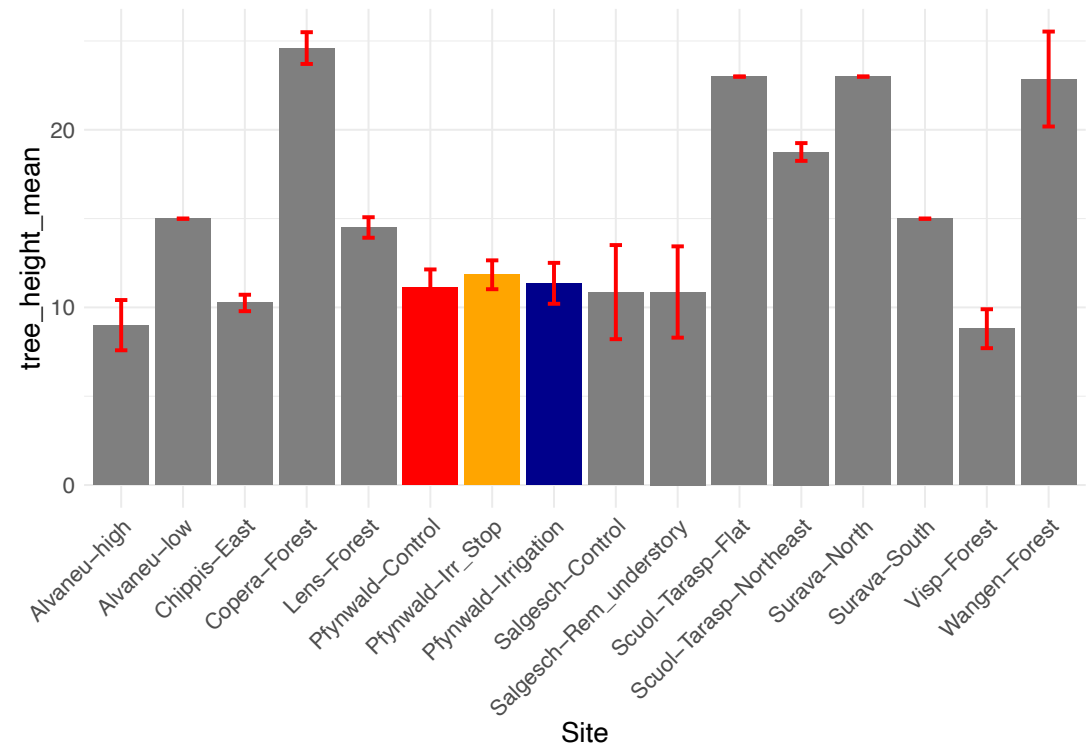


Comparison of PFY pines to other TreeNet pines

Diameter at breast height [cm]

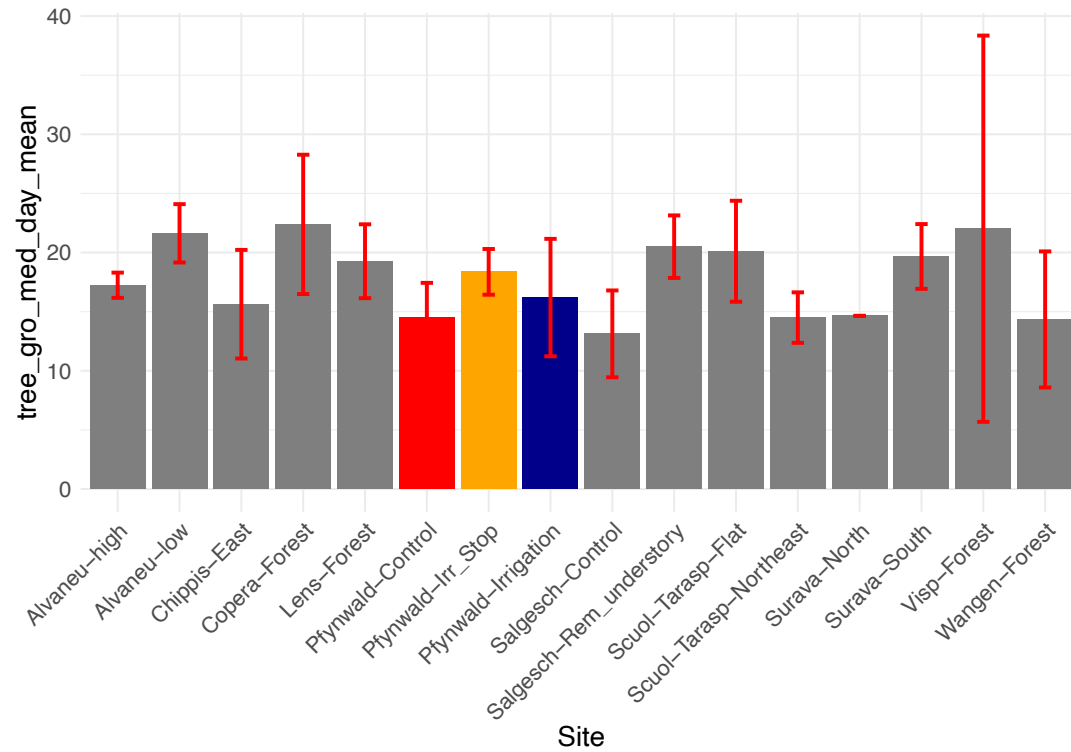


Tree height [m]

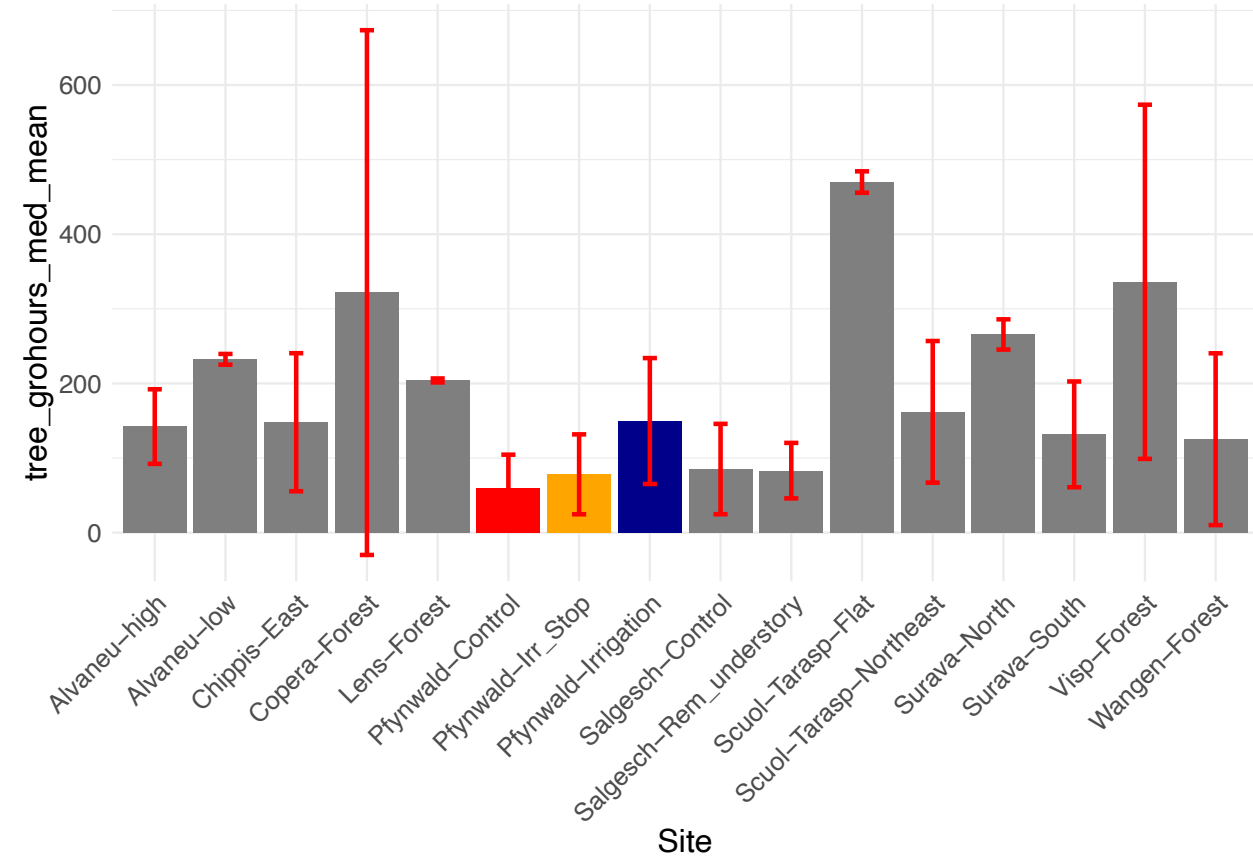


Comparison of PFY pines to other TreeNet pines

Average growth rate per day [μm]

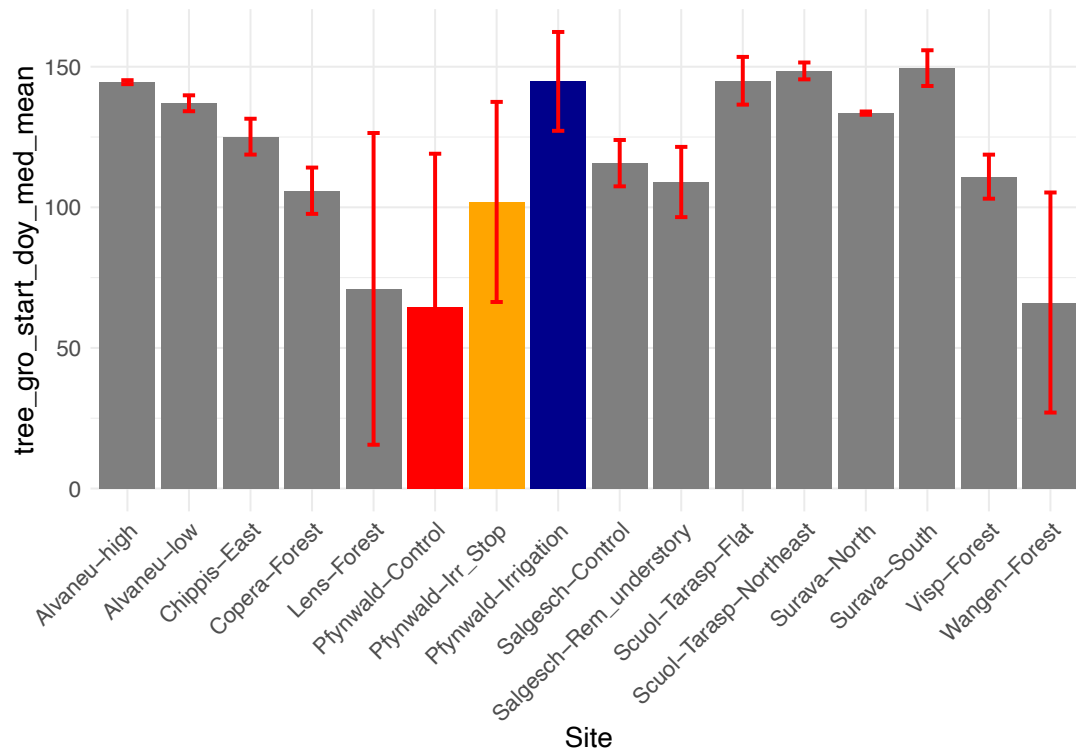


Hours with growth [hours per year]

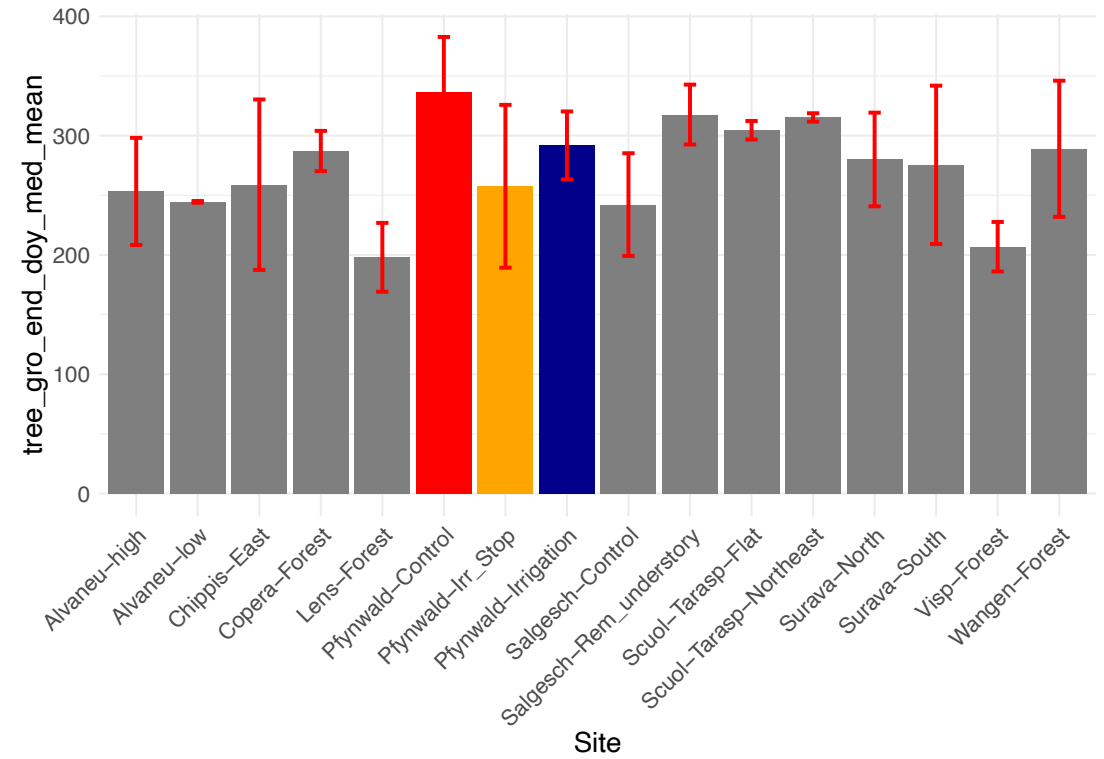


Comparison of PFY pines to other TreeNet pines

Growth start [Day of year]

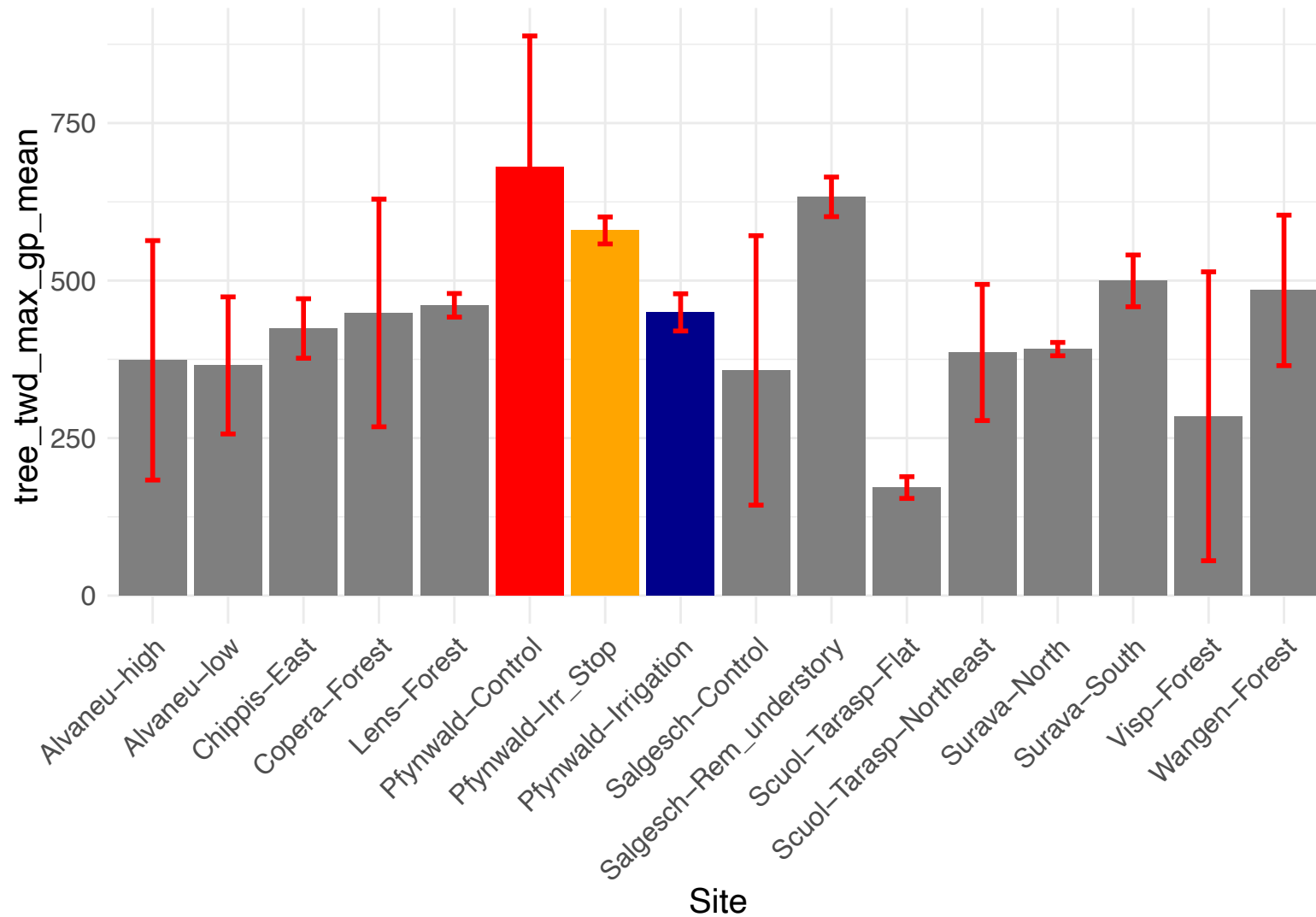


Growth end [Day of year]



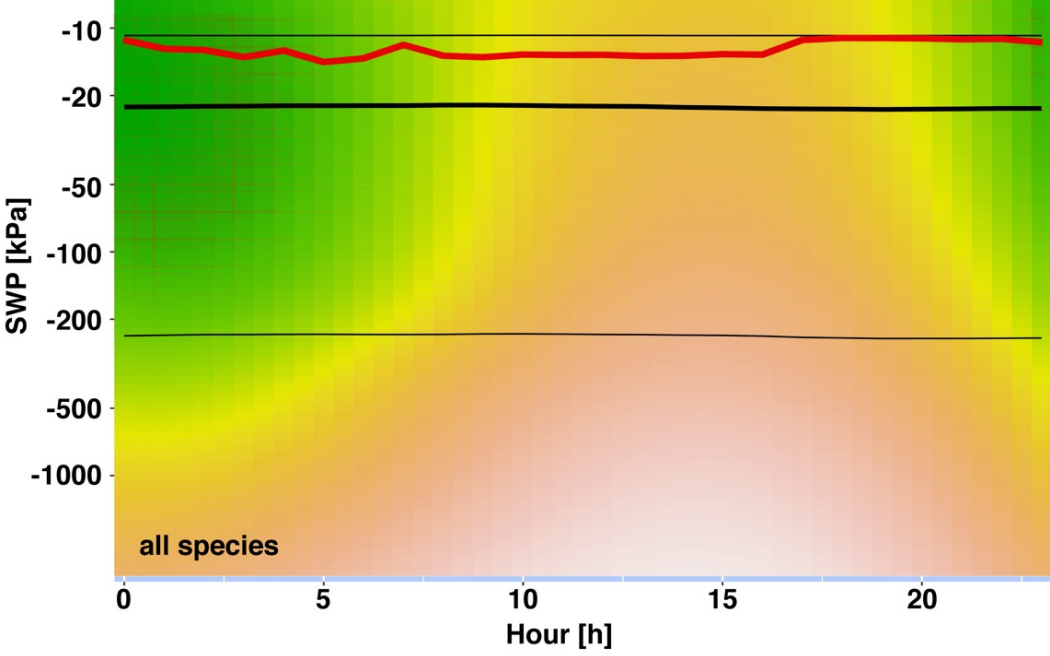
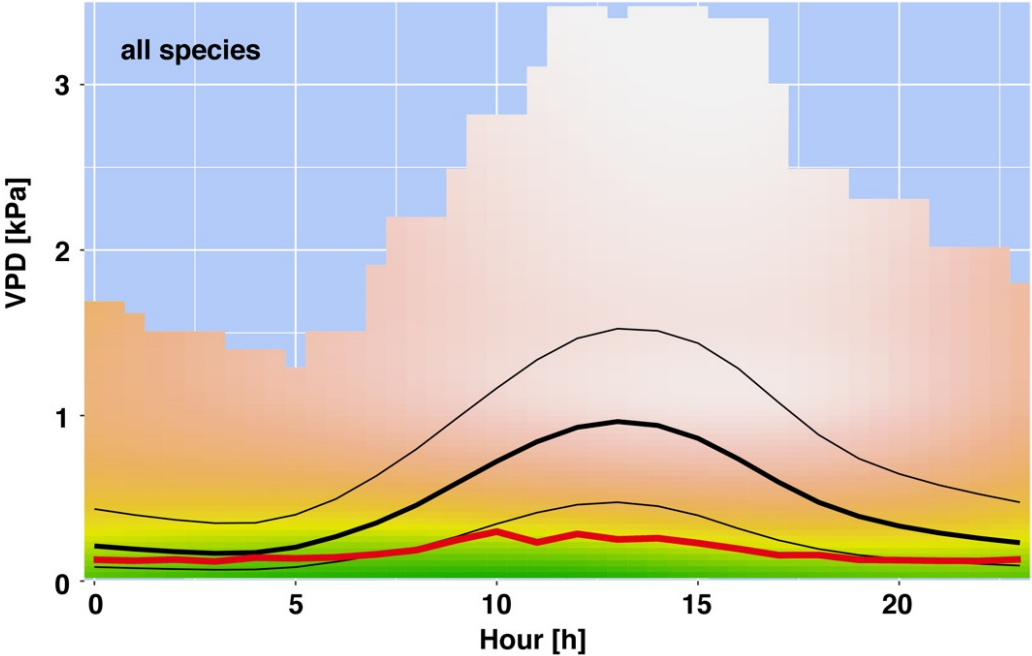
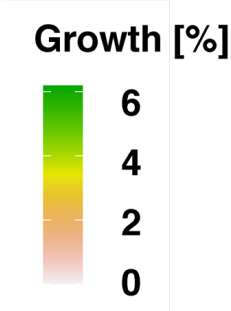
Comparison of PFY pines to other TreeNet pines

Tree water deficit (maximum during growth period) [μm]

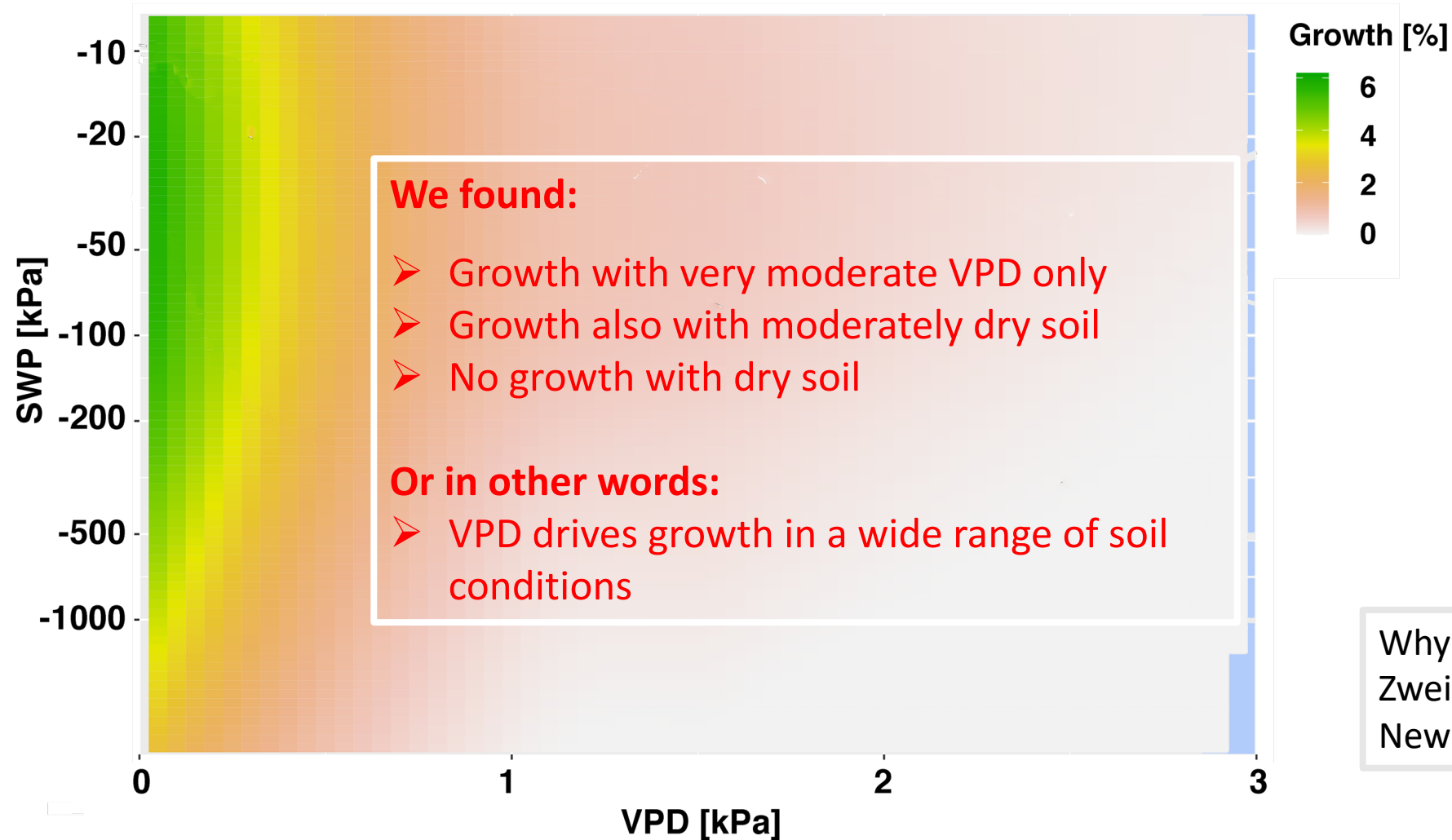


Disentangling the drought effects of air and soil

Why trees grow at night
Zweifel et al 2021
New Phytologist

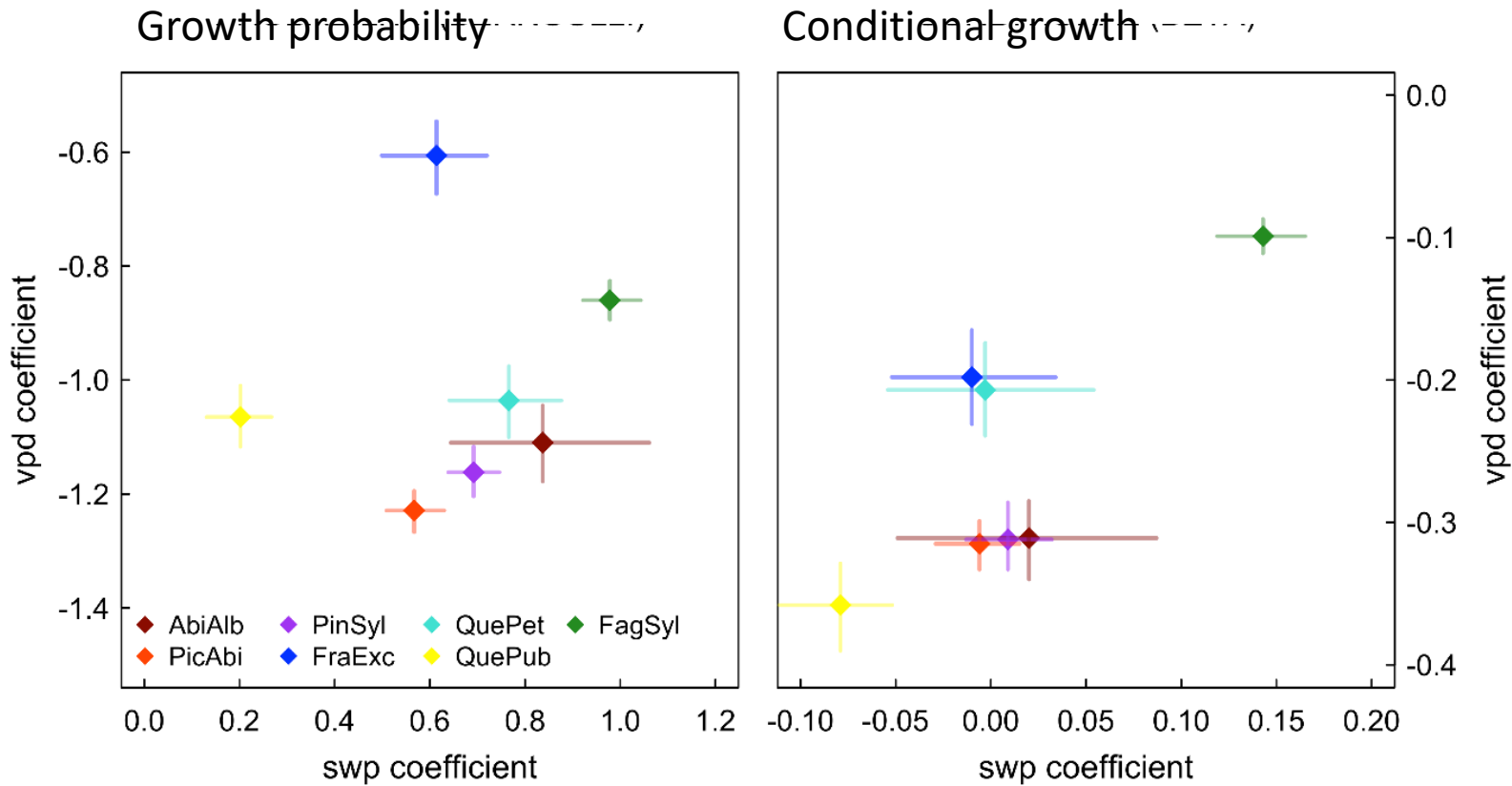


Disentangling the drought effects of air and soil



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New Phytologist

Disentangling the drought effects of air and soil



Coming soon:

Sterck et TreeNet:

- New Bayesian model to predict growth
- Disentangling of VPD and SWP effect

Personal interest into new PFY infrastructure

- Getting new data to develop mechanistic understanding of growth
- Testing our concepts and models
- Linking PFY results via TreeNet to other forest research sites

