The rhythm of trees - the fascination of watching trees grow



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TreeNet Conference
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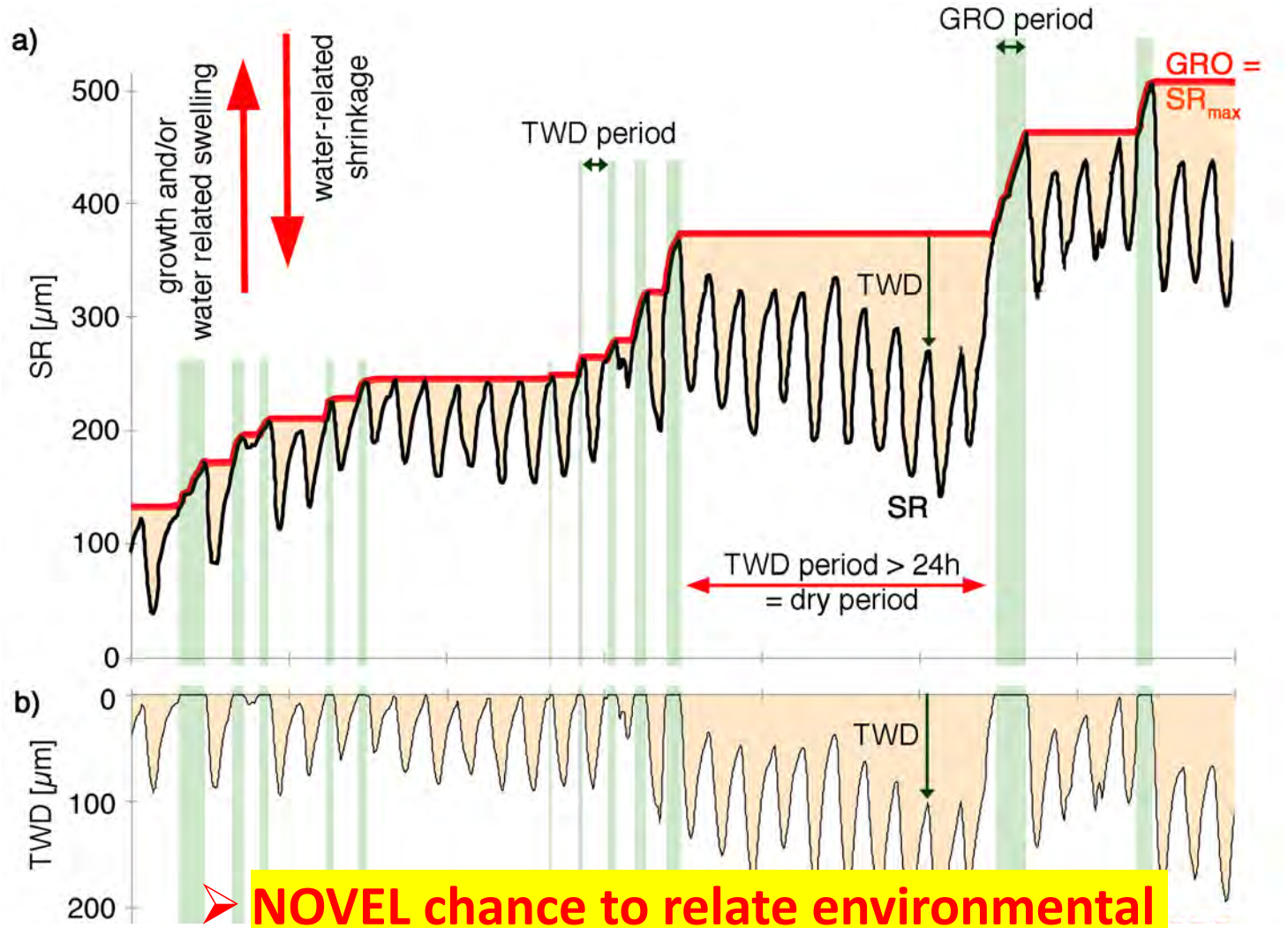
Point dendrometers …

… a method to monitor radial stem growth and tree water relations



- **NOVEL chance to relate environmental conditions to growth at an hourly resolution**
- **And display that in near real-time!**

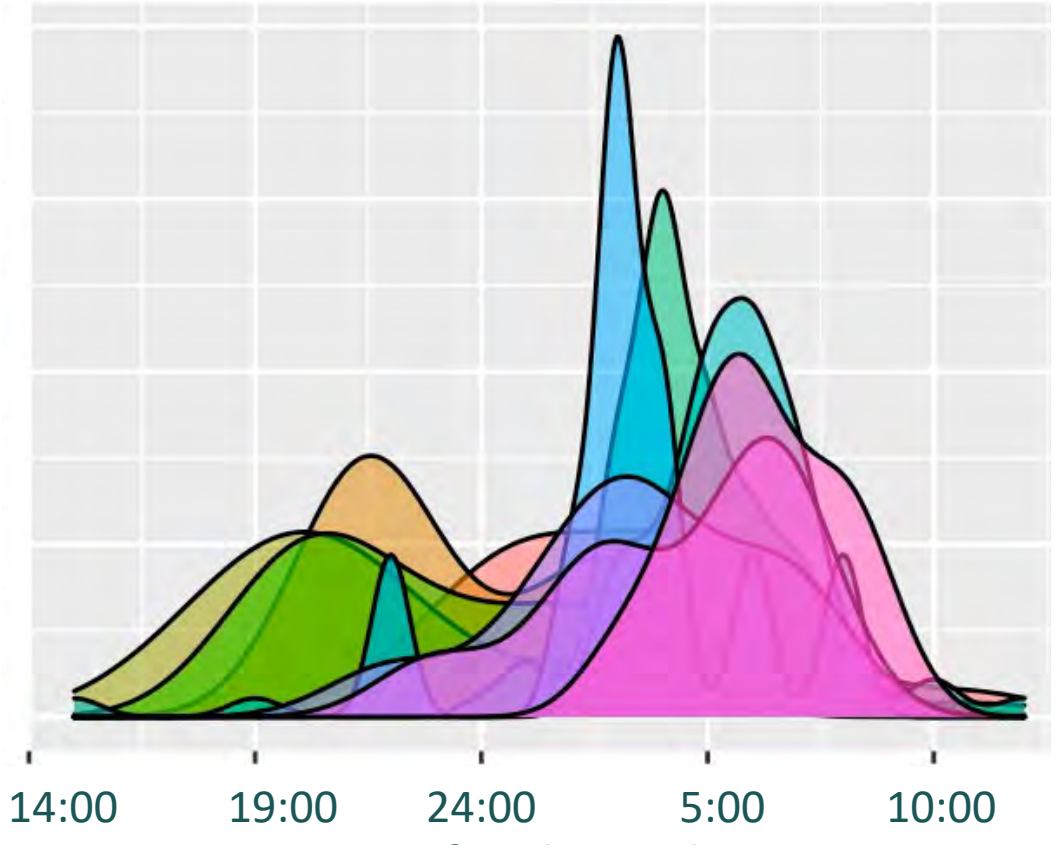
The fascination of watching trees grow

- Does the diel stem radius rhythm tell us something about a tree's annual growth performance?
- What happens to stem growth when the spruce is decapitated by a storm or the beech is knocked down, but the sensors continued to run unharmed?
- Nowcasting with TreeNet

The fascination of watching trees grow – Part I

- Does the diel stem radius rhythm tell us something about a tree's growth performance?

Abies alba
Acer pseudoplatanus
Carpinus betulus
Fagus sylvatica
Picea abies
Pinus sylvestris
Quercus cerris
Quercus petraea
Quercus petraea x robur
Quercus pubescens



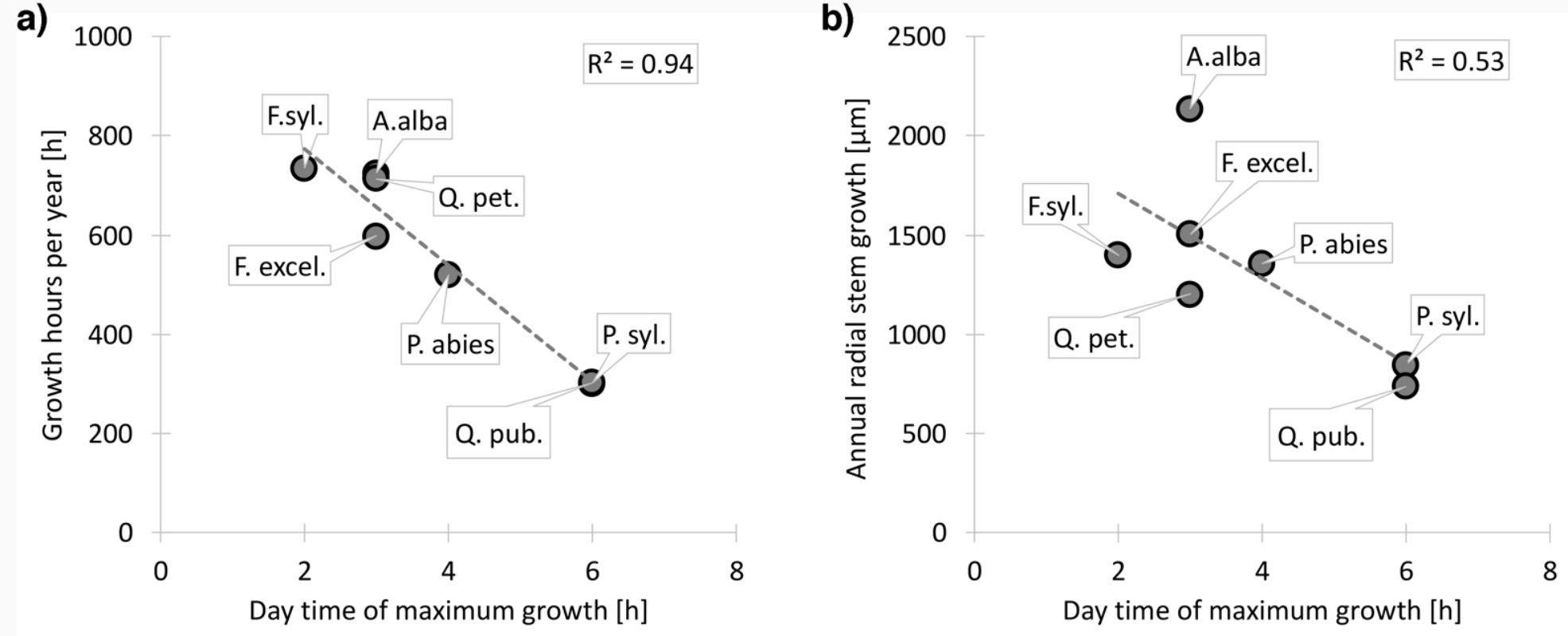
We found:

- ➢ Huge variation of peak growth timing
- ➢ What can we deduce from this?

Zweifel et al 2021

The fascination of watching trees grow – Part I

- Does the diel stem radius rhythm tell us something about a tree's growth performance?

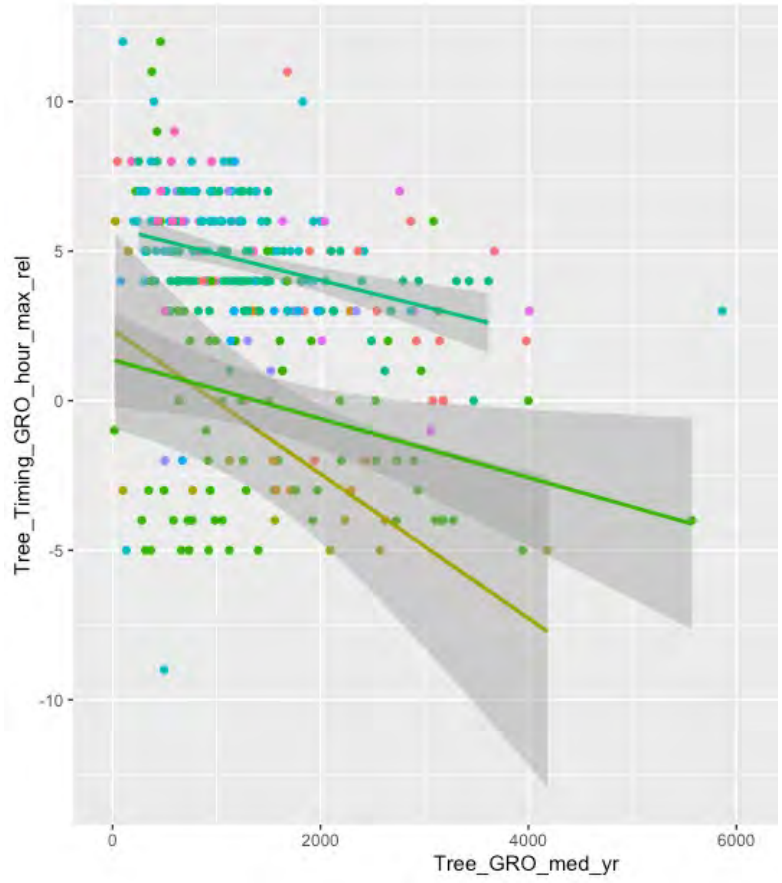


We found:

➢ Species growing earlier in the night have a larger (annual) growth potential

The fascination of watching trees grow – Part I

- Does this hold for individual trees of a species as well?



Corr: -0.304***
Abies alba: -0.390.
Acer pseudoplatanus: -0.283
Carpinus betulus: -0.674*
Fagus sylvatica: -0.262*
Picea abies: -0.430***
Pinus sylvestris: -0.116
Quercus cerris: 0.016
Quercus petraea: -0.134
Quercus petraea x robur: -0.549
Quercus pubescens: -0.301

We found:

- ➢ The earlier the growth peak the more the annual growth
- ➢ Significant for some species only

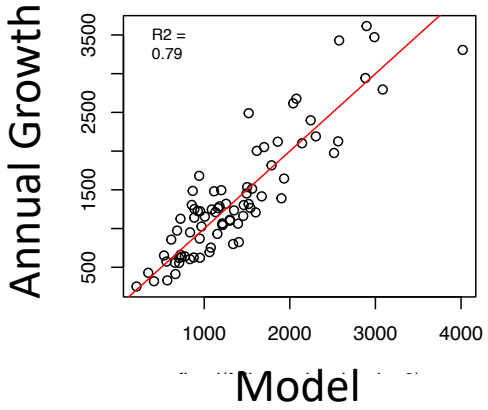
The fascination of watching trees grow – Part I

- Does this hold for individual trees of a species as well?

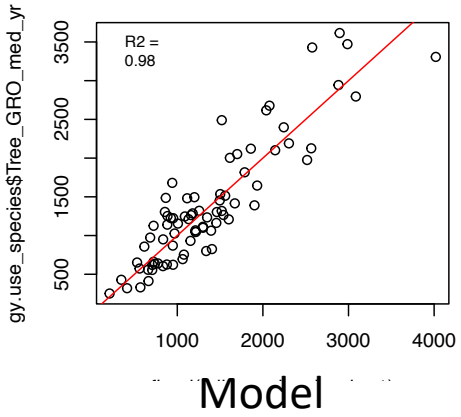
Spruce

Beech

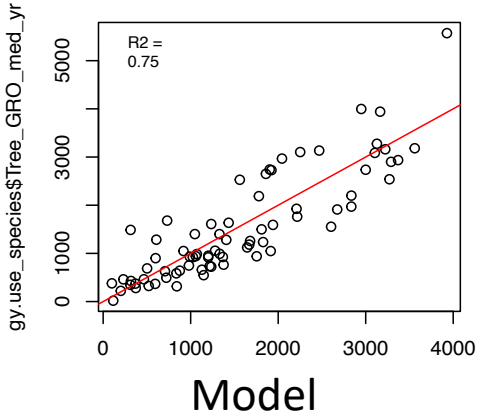
Fixed effects



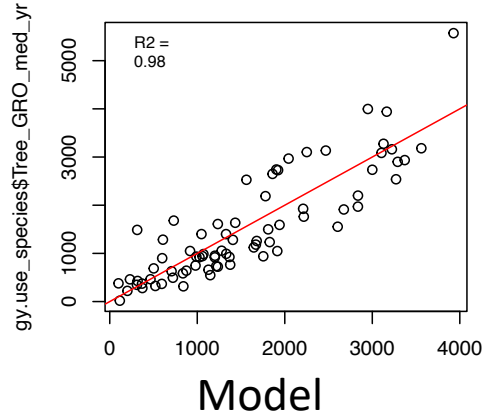
fixed and random



Fixed effects



fixed and random



lme (fixed effects)
GRO_med_hr
Grohours
Peak hour timing

lme (random effects)
Tree_species
Site
Tree

We found:

- In LME model, number of growth hours per year is essential
- Together with peak hour timing and hourly growth rate


WSL 2021
Storm at 2 am 13 July 2021

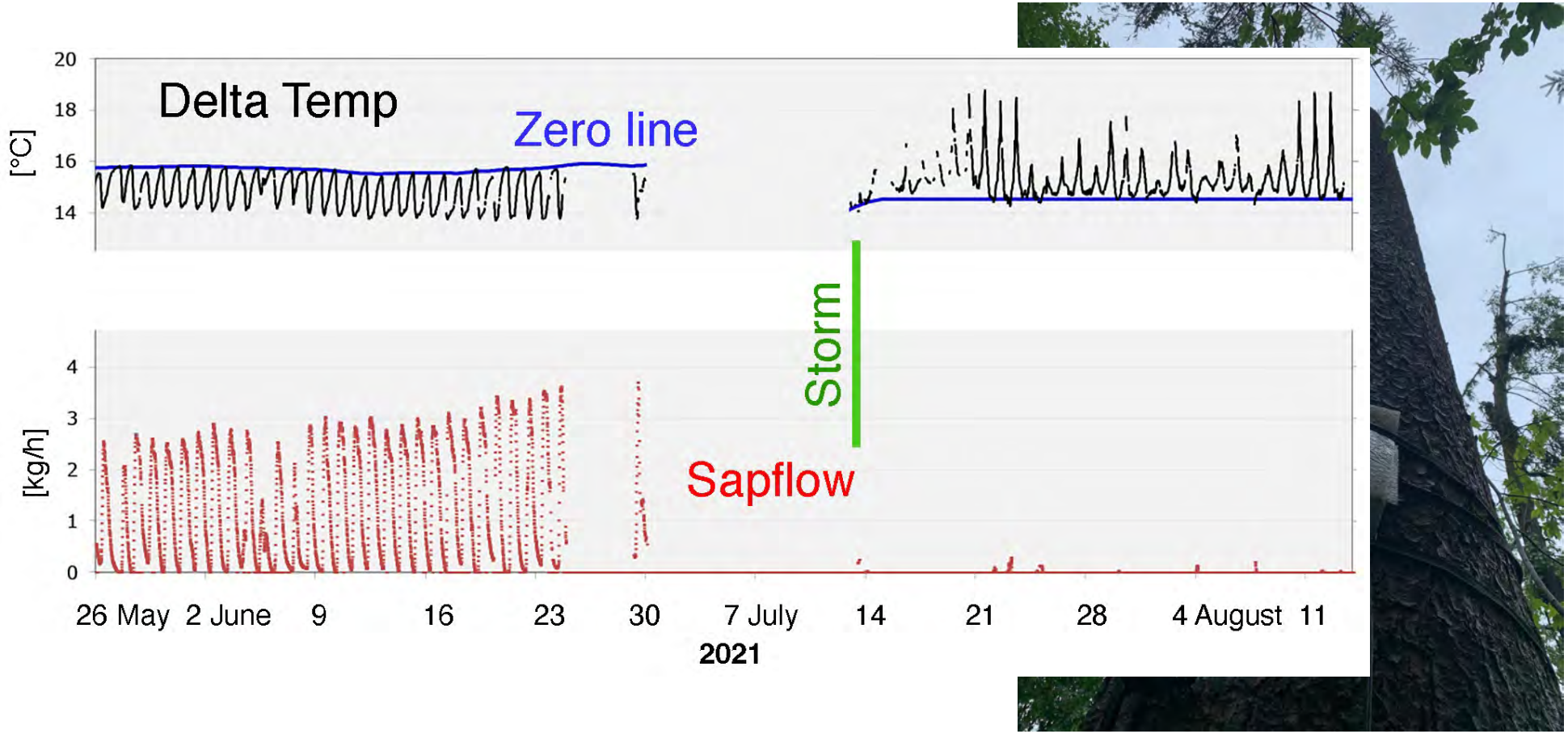
The fascination of watching trees grow – Part II

What happens to a decapitated or knocked down tree?

- 30 m Norway spruce decapitated at 4 m
- No branches and needles left
- Sensors at the stem unharmed

The fascination of watching trees grow – Part II

- What happens to a decapitated or knocked down tree?

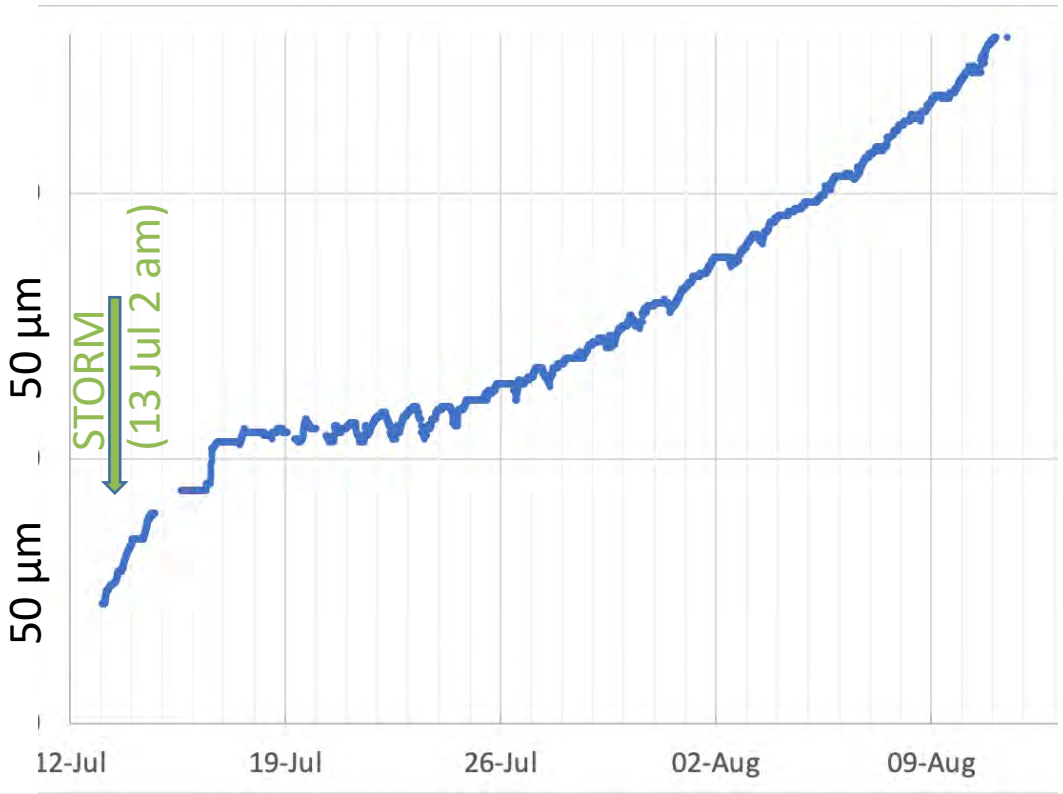


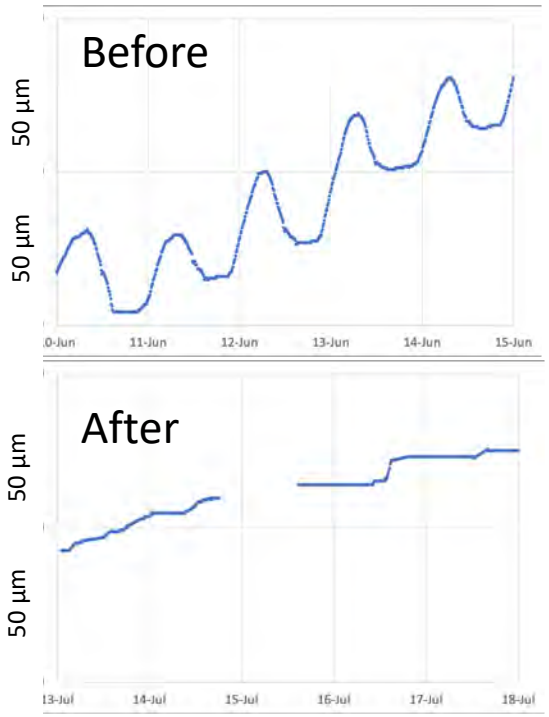
We found:

➢ Sapflow completely stopped

The fascination of watching trees grow – Part II

- What happens to a decapitated or knocked down tree?

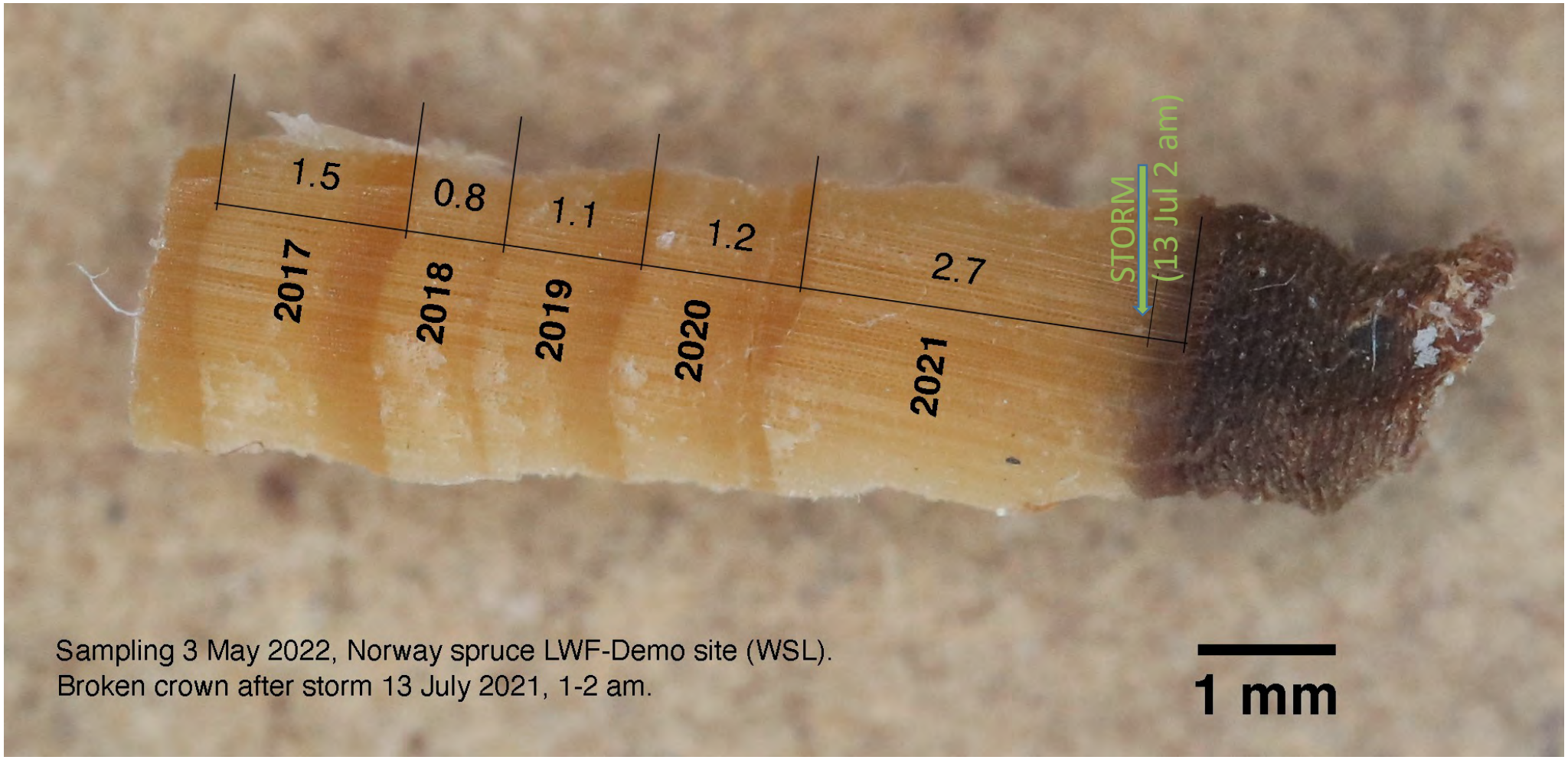




We found:

- ➢ Considerable growth after the storm (0.2 mm)
- ➢ Very little daily shrinkage

The fascination of watching trees grow – Part II



We found:

- Ca 5-10% of annual growth after storm
- No growth in 2022 anymore

The fascination of watching trees grow – Part II

How is that possible?

We conclude:

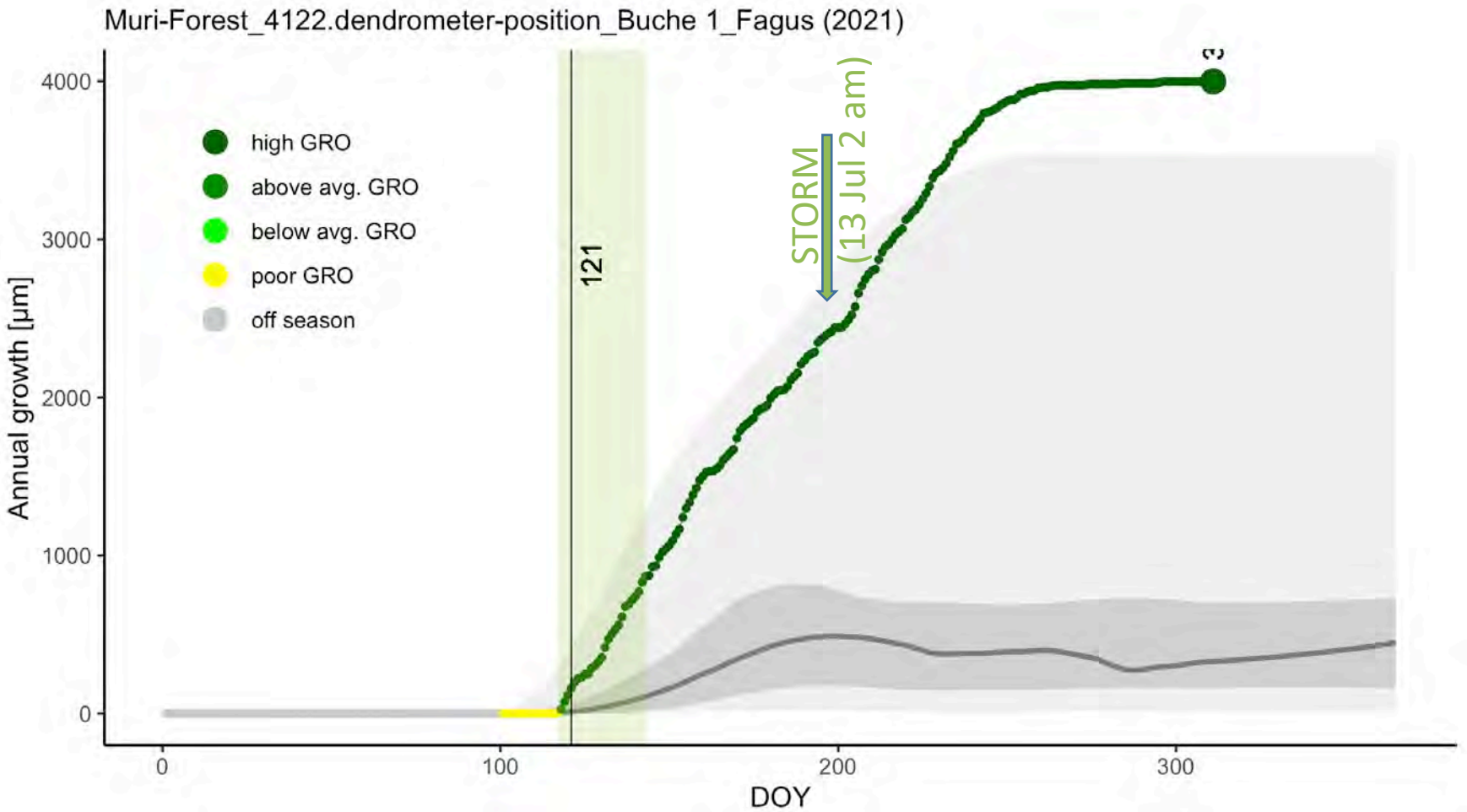
- Due to a release of negative water potentials
- Enough carbon and balanced water relations

- Support for turgor threshold theory for growth
- Support for theory of sink-driven growth

Muri 2021

The fascination of watching trees grow – Part II

- What happened to beech trees felled by the storm (the root partially still in the ground, sensors unharmed)?



The fascination of watching trees grow – Part II

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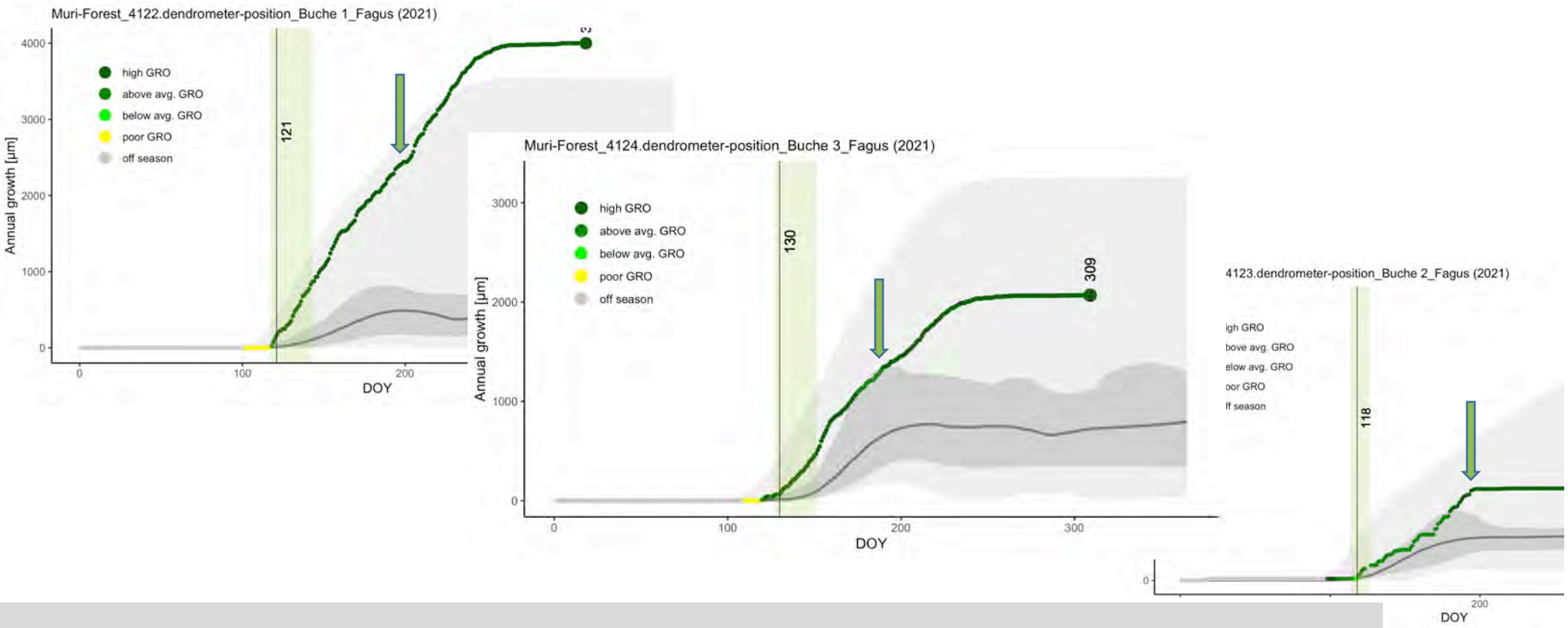
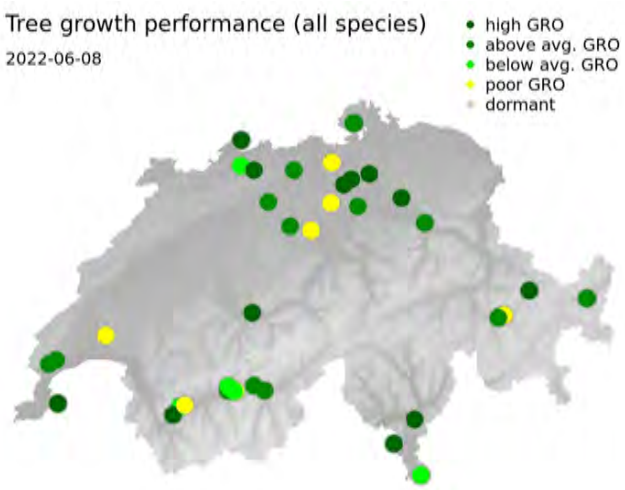


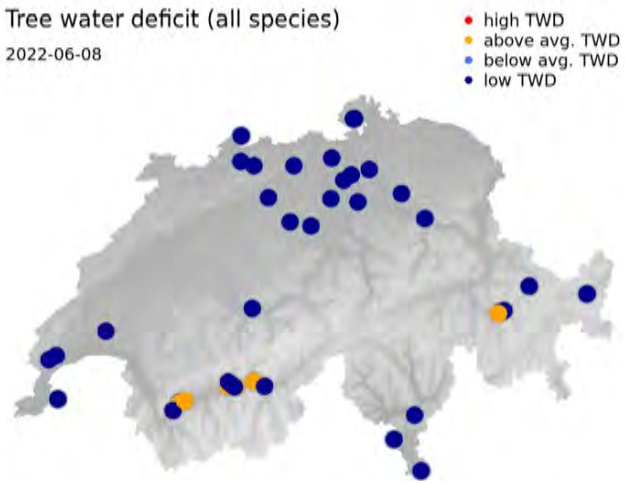
We found:

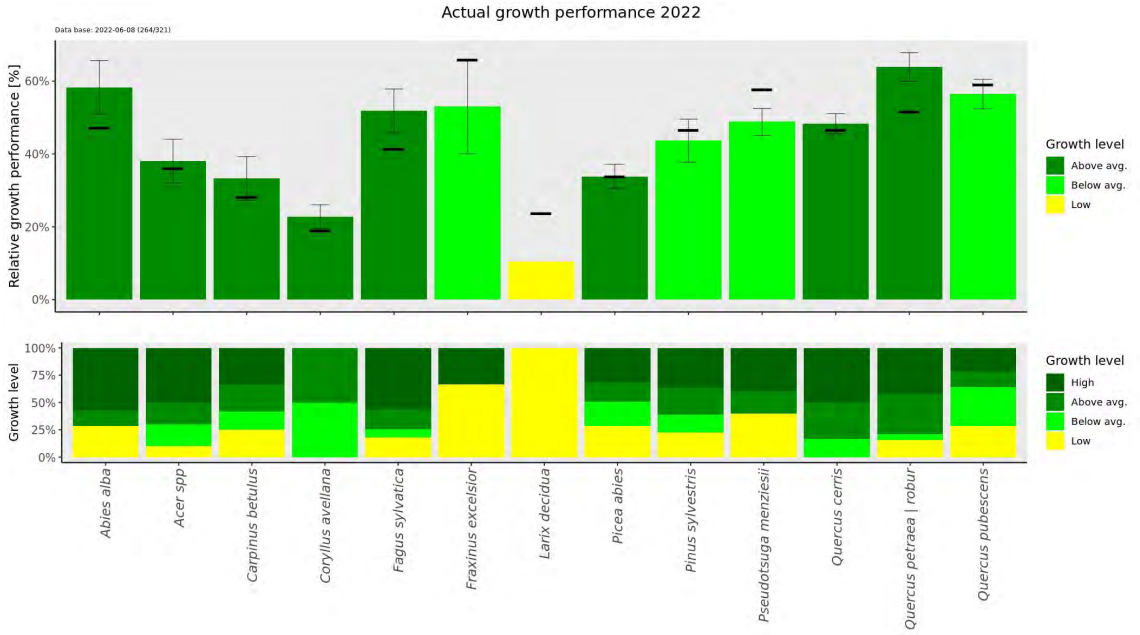
- Considerable growth after the storm 20-30% of annual growth in 2 of 3 trees
- Apparently no limiting factors for growth despite the fall of the trees

The fascination of watching trees grow – Part III

Nowcasting with TreeNet







➢ https://treenet.info

Thank you!



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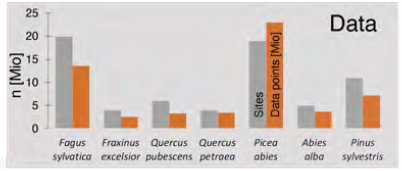
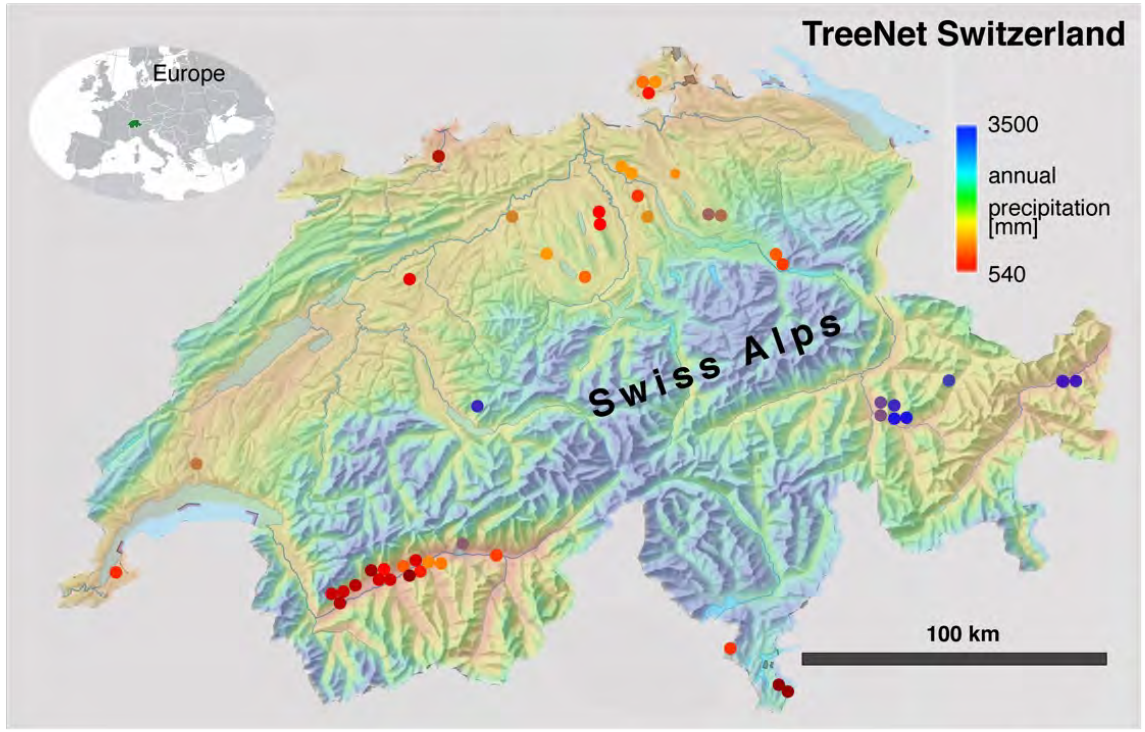
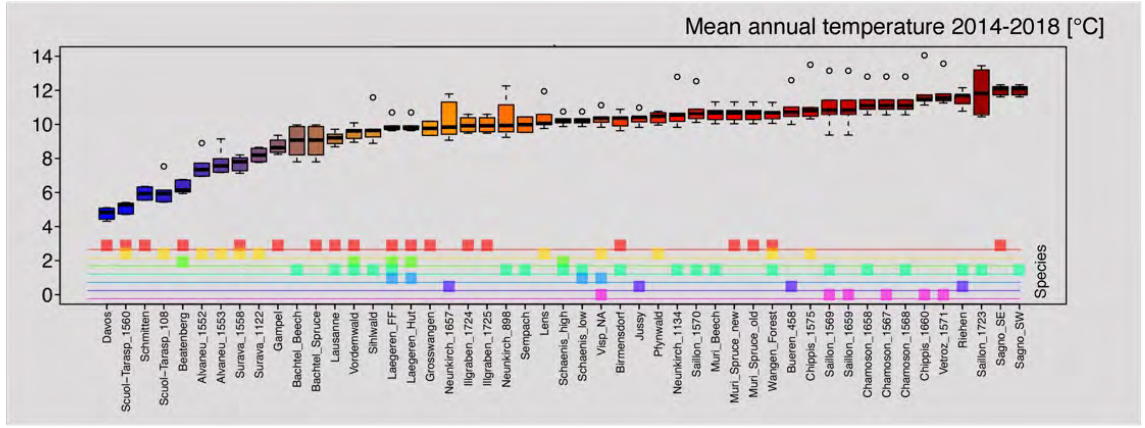
and many more …

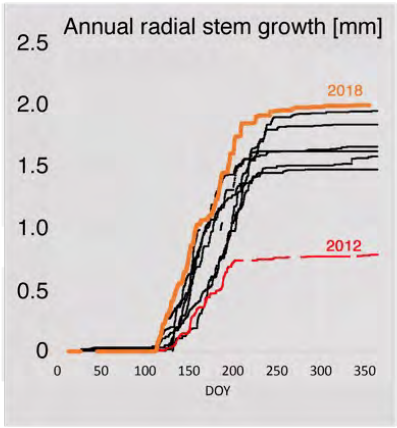
TreeNet – the biological drought and growth indicator network

WSL, ETHZ, IAP, Uni Basel









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