Norway spruce susceptibility to stress in lower altitudes: experiment introduction

Černý Jakub

Forestry and Game Management Research Institute, Department of Silviculture, Opočno, Czech Republic

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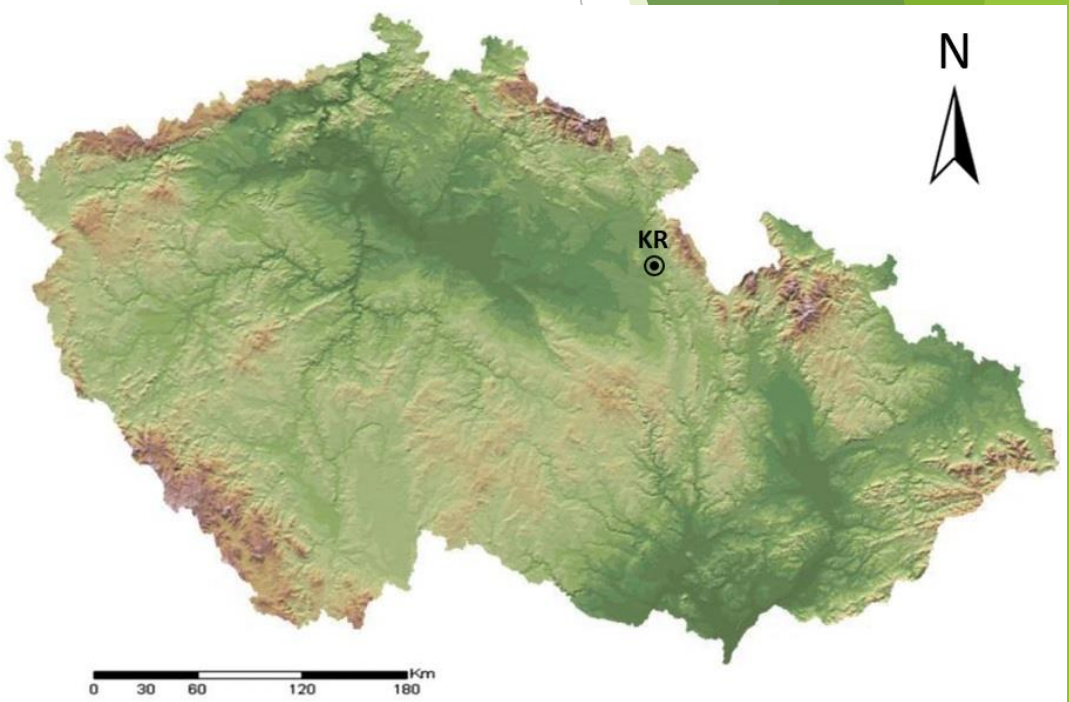
Study site

- 50°12′ 55.376″N; 16°06′50.669″ E
- 402 m a. s. l.
- Cambisol
- 10.4 °C (2018-2020)
- 606.3 mm (2018-2020)
- *Querceto-Fagetum illimerosum trophicum* (Loamy Oak-Beech)



Design of experiment

- Established in 2018 (12-year old Norway spruce pole stand)
- 3 plots (40 x 65 m) + open area (meteorological measurements)
- Pre-commercial thinning in February 2020 (all logging residuals were removed)
- Initial stand density – 4,500 trees ha^{-1}

Pre-commercial thinning intensities

A

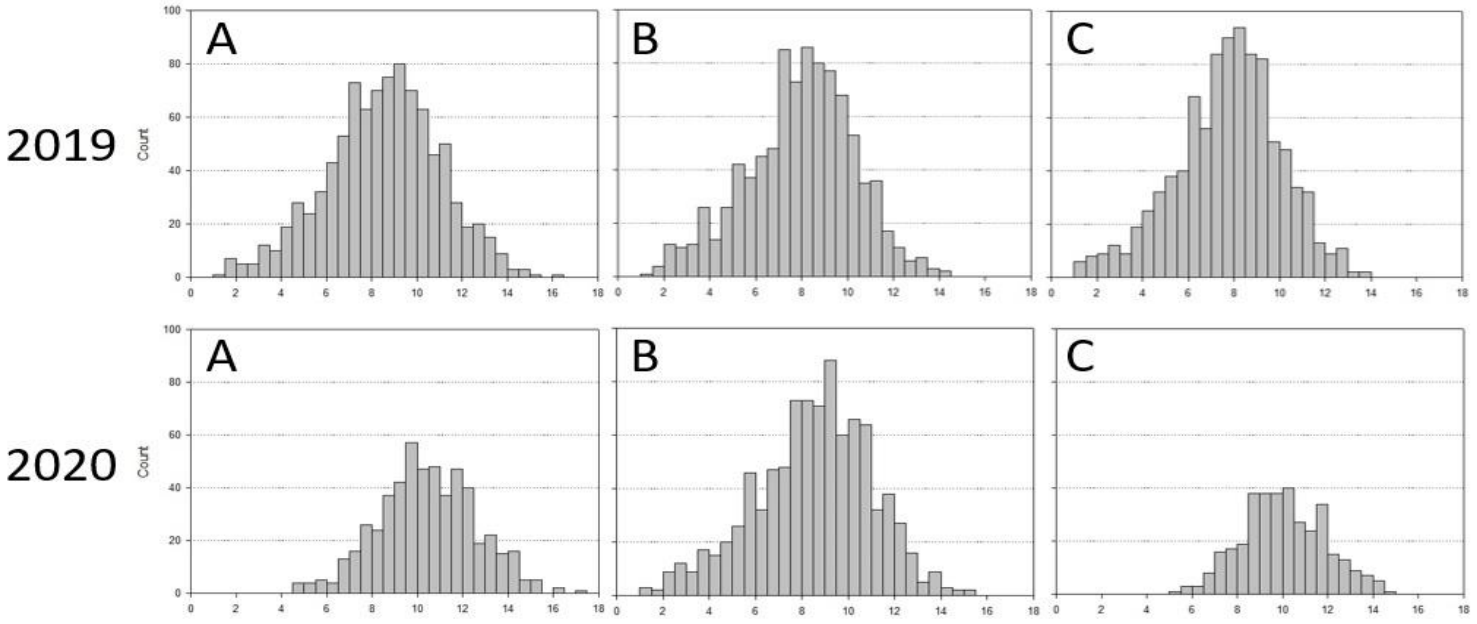
1,800 trees ha^{-1}

B

4,500 trees ha^{-1}

C

1,300 trees ha^{-1}



Before thinning

After thinning

Main objective:

Analysis of silvicultural treatments effect on:

- ❑ Growth dynamic
- ❑ Tree vitality
- ❑ Microclimatic conditions
- ❑ Soil properties

Main working hypothesis:

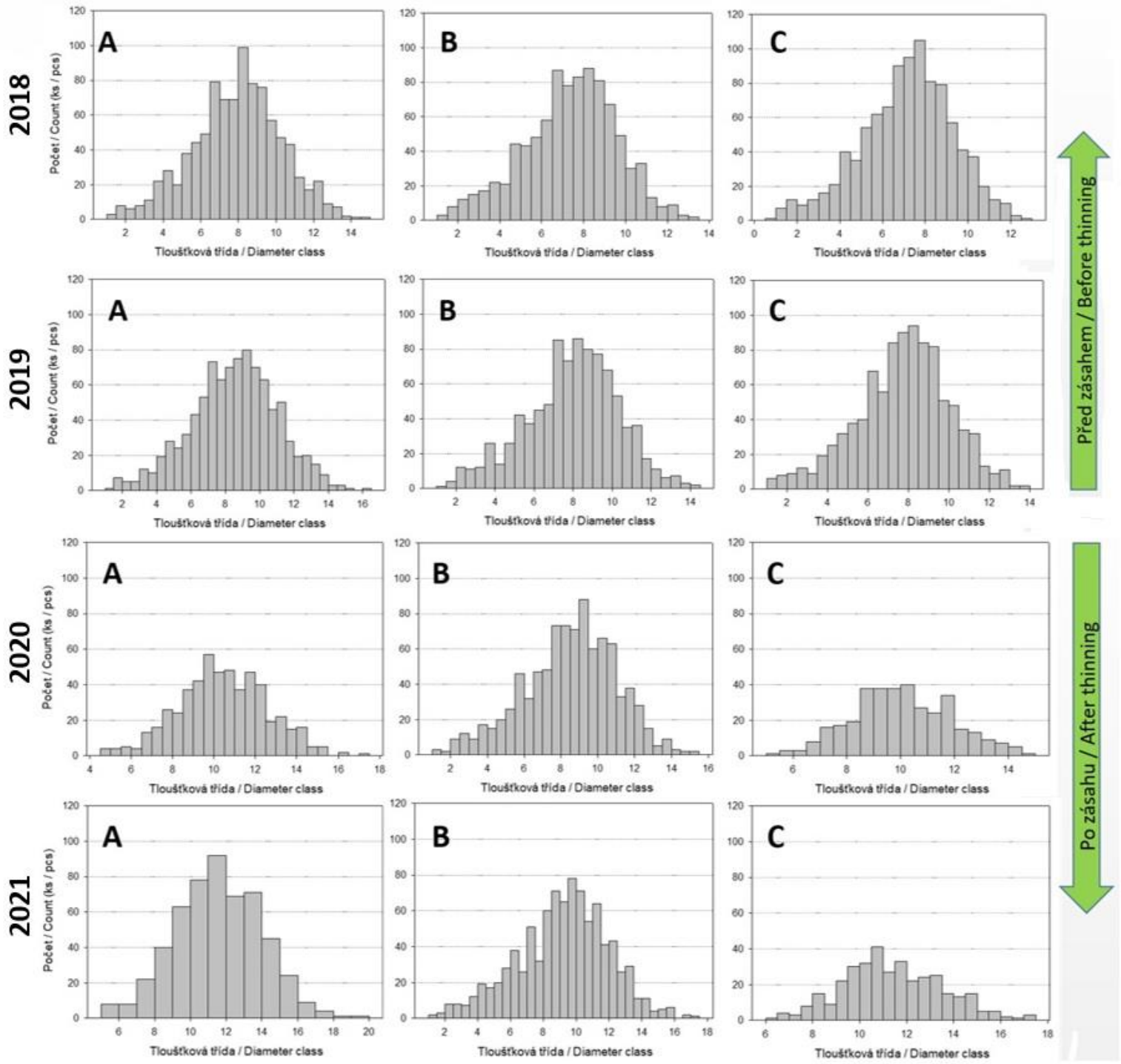
H_0: Silvicultural treatments will positively affect parameters mentioned-above due to lower competition

Meteorological measurements in open area

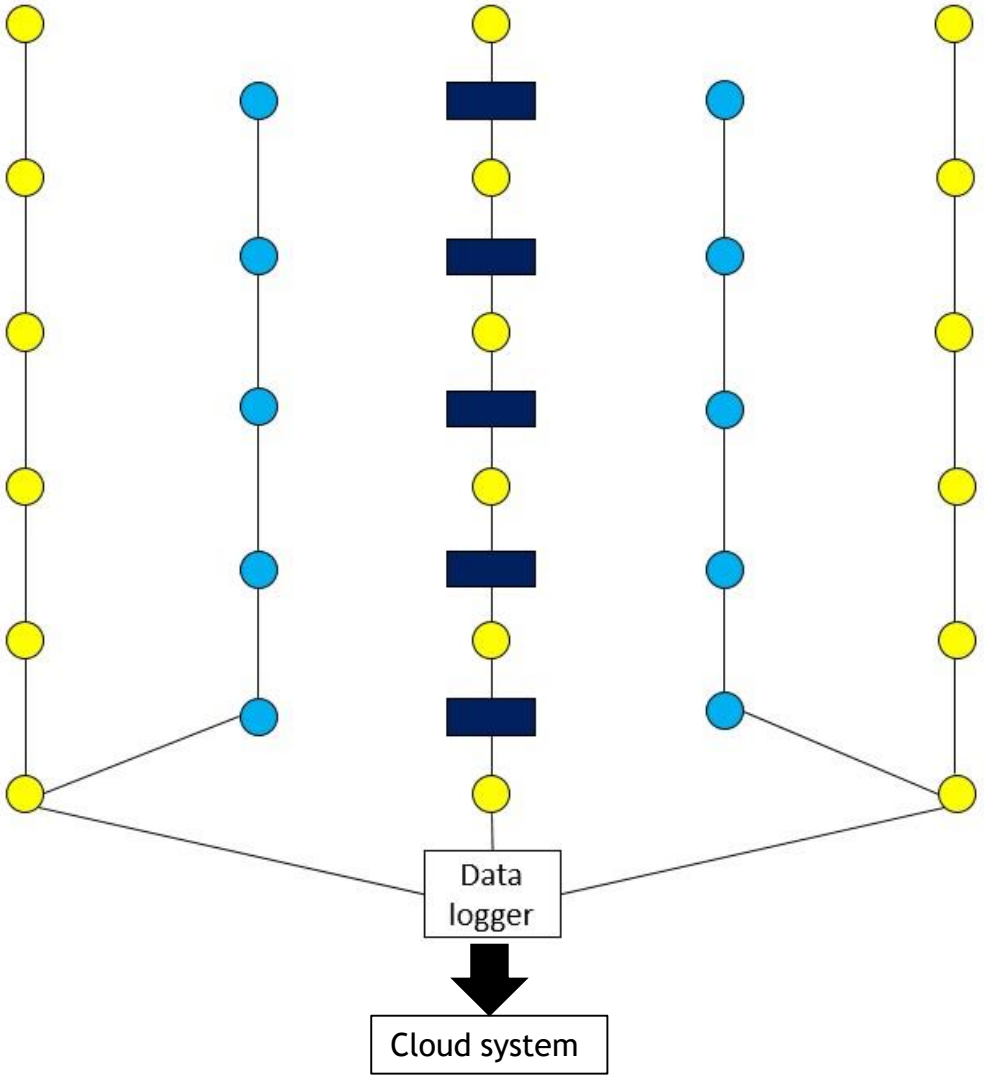
- Clearing (0.75 ha)
- 100 m aside research plots
- From 2018
- Cloud system

Stand inventory

- ❑ Every year from 2018
- ❑ September
- ❑ DBH, H (all trees)



Below-canopy measurements



PAR (18)

Soil moisture (10)

Throughfall (5)

Stem radial increment

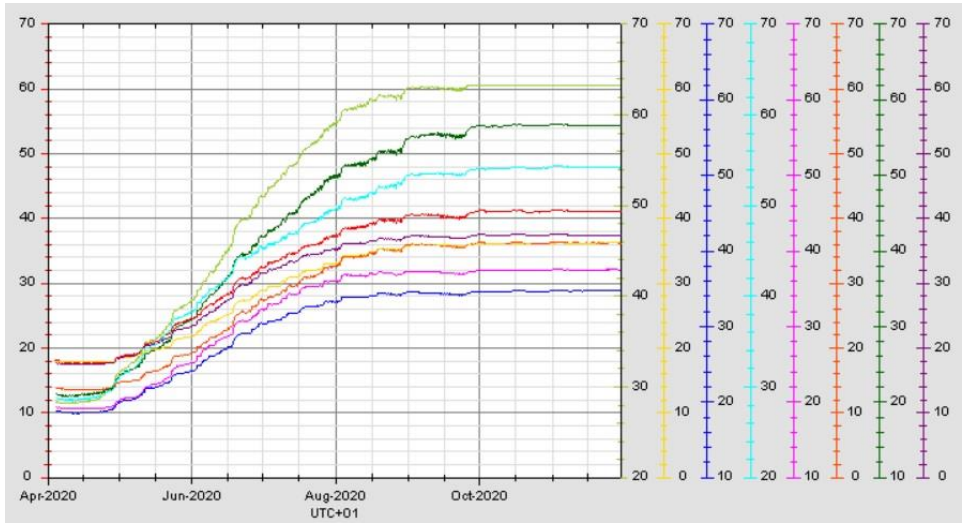
Morphological level
Anatomical level

Manual dendrometers

- ❑ 15 pcs per plot
- ❑ 2-week interval

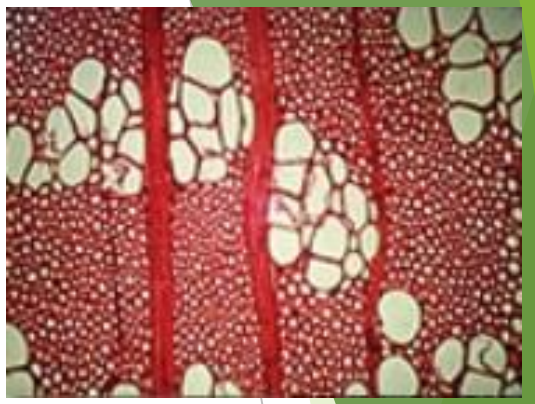
Automatic dendrometers

- ❑ 9 pcs per plot
- ❑ Continual measurements



Stem radial increment

Morphological level
Anatomical level



- 6 sample trees per plot (from 2021)
- Sampling every week (11/03/2020 – 12/11/2020; 15/03/2021 – 10/11/2021; 29/03/2022 - now)
- Sampled according to Rossi et al. (2006)

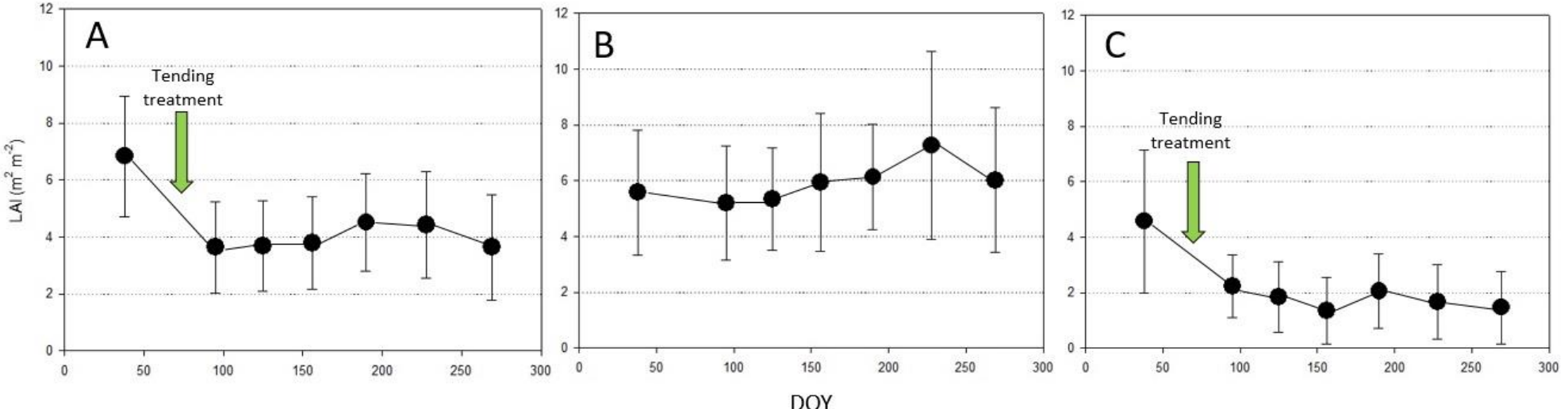
Leaf area index (LAI) measurements

- 18 measurement points per plot (i.e. above PAR sensors)
- DHP (Regent Instruments, Canada); LaiPen LP 110 (PSI, CR); LAI-2200 PCA (LI-COR, NE, USA) – dual mode
- Both before and after pre-commercial thinning application

In 2020

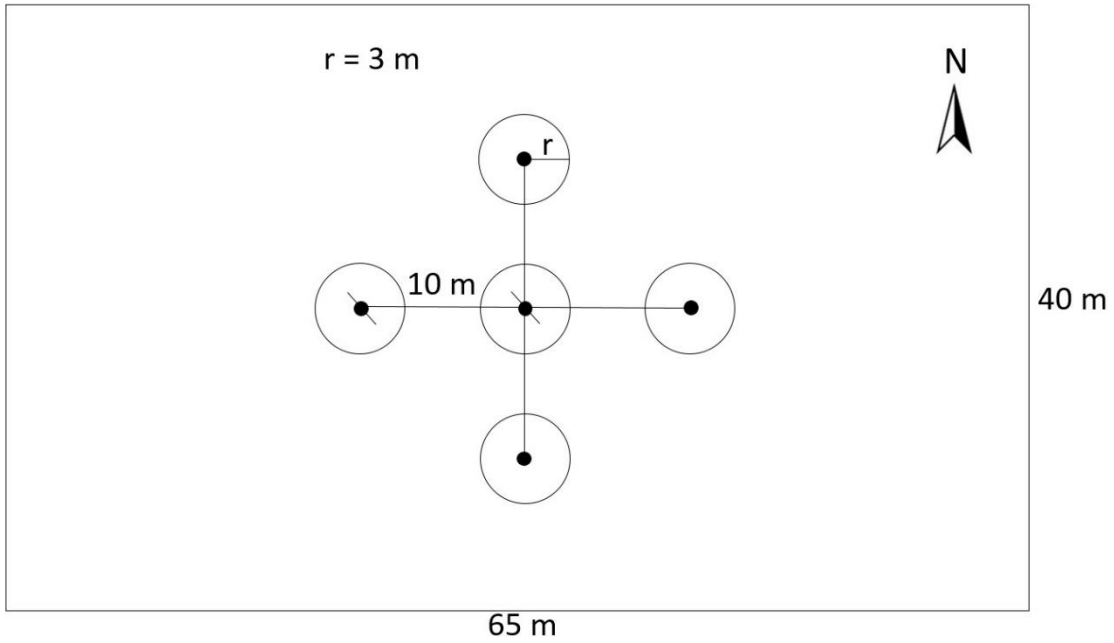
From 2023

2020



Soil analysis

- In 2020, pH and concentration of macro and microelements (C, N, Ca, Mg, K, P, Mn, Fe, Zn)
- Samples from 6 horizons (litter, fragmented, humus layer, 3 mineral layers)
- Sampling followed Bravo-Oviedo et al. (2015)
- Repetition in 2024-2025



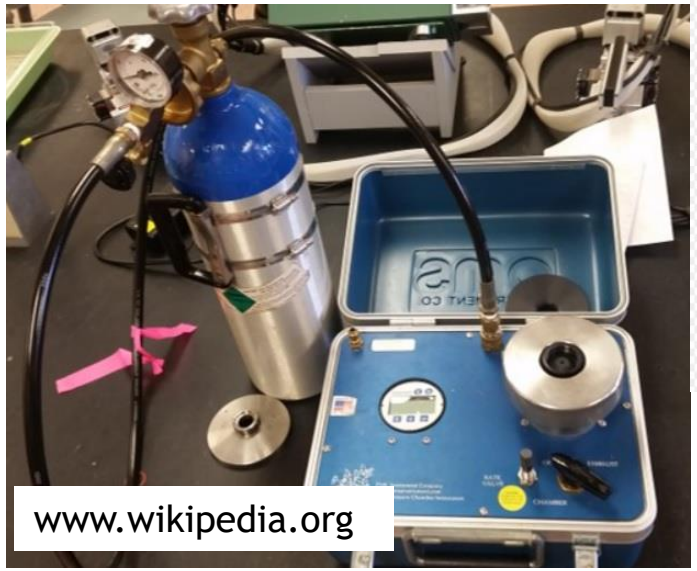
Transpiration

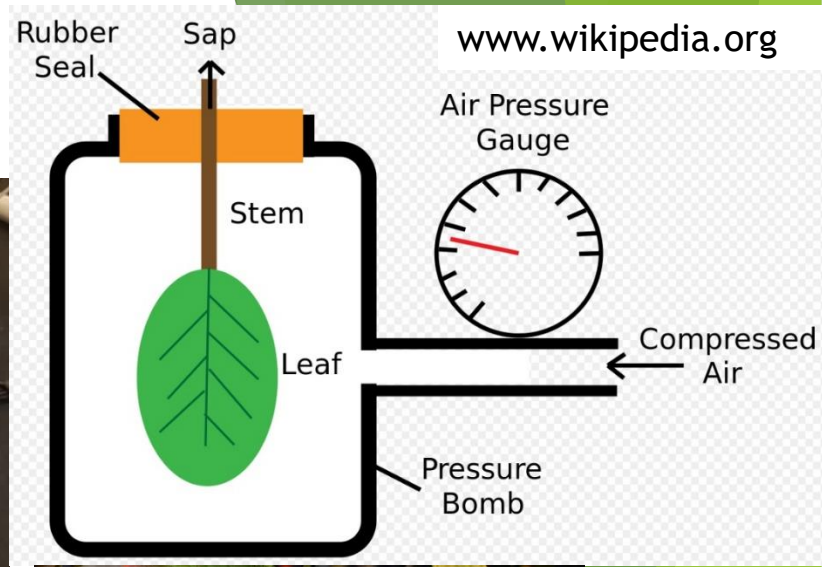
- Sap-flow continual measurements from 2021
- 2 sampling trees per plot (will be spread in 2023)
- Sensors equipped by automatic dendrometers
- Soil water potential will be also measured by 6 sensors per plot from 2023

Photo: EMS Brno

Foliage water potential

- ❑ 6 trees per plot (from N side)
- ❑ Biweekly from 2020
- ❑ Scholader pressure chamber





Chlorophyll fluorescence

- ❑ 6 trees per plot (from N side)
- ❑ Biweekly from 2020
- ❑ FluorPen FP 110 (PSI, CR)

What to do?

Allometric relationships

- ❑ Destructive analysis in autumn 2022-spring 2023
- ❑ Methodology according to Pokorný and Tomášková (2007)
- ❑ Allometric equations for aboveground biomass calculation (i.e. stems, branches, foliage)

Stem positions

- ❑ Field-Map technology (IFER, CR)

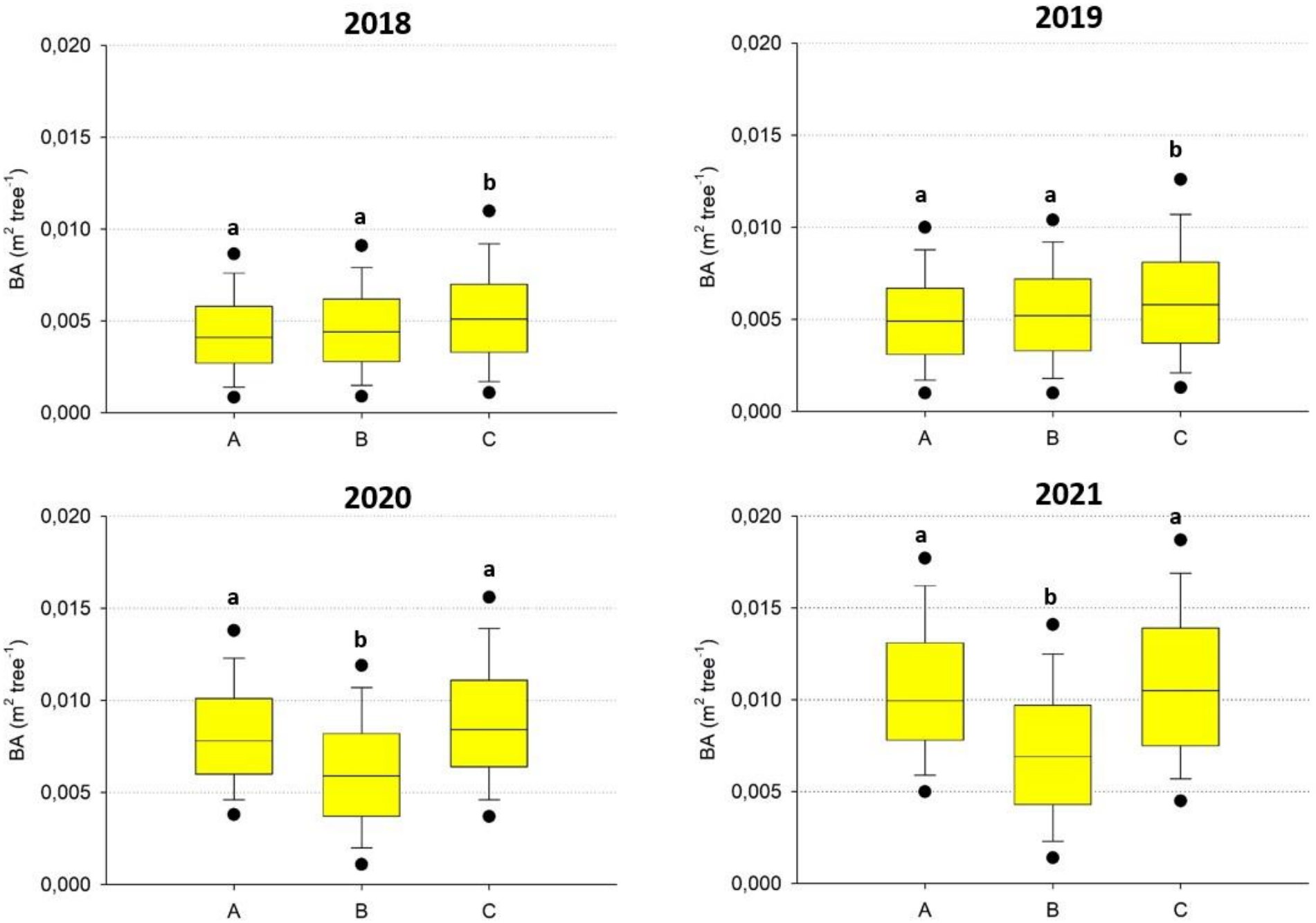
Radiation use efficiency (RUE)

- ❑ Both at stand and tree level

Preliminary results

Before thinning

After thinning



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Thank you for your attention!

Ing. Jakub Černý, Ph.D.
cerny@vulhmop.cz
jakubcern@seznam.cz