THE EVALUATION OF MICROSITE EFFECTS ON THE VITALITY AND GROWTH OF NORWAY SPRUCE IN A LOW-ELEVATION PLANTATION FOREST

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INTRODUCTION

- Tree uprooting is a natural phenomena that influence both forest soils and tree regrowth.
- Mounds left after tree uprooting are preferable microsites for trees (Šebková et al. 2012).
- **Aims**: to assess (i) the depth distribution and (ii) sap-flow dynamics, in trees growing on mounds vs. on control microsites.

METHODS

- Two sites within the Training Forest Enterprise Masaryk Forest Křnity (Kupec et al. 2018)
- Even-aged plantations of Norway-spruce at 300 – 550 m altitude in different stand age
- Well-developed pit-mounds after historical tree uprooting, with a canopy spruce tree on mound

DENDROMETRY

- Tree on mound + all adjacent trees + the same number non-adjacent trees (site Křtiny)
- The stem perimeters at breast height (DBH)
- Mixed effect models + multiple comparison to test the effects of tree position on DBH

ECOPHYSIOLOGY

- Three mature Norway spruce trees growing on mound + three control trees (site Kanice)
- Sap-flow dynamics: trunk heat balance method (EMS 51, datalogger V16; EMS Brno, Czechia)
- Weather: global radiation, precipitation, air temperature, humidity, wind speed & direction
- Soil water potential using gypsum blocks (GB2, Delmhorst, USA) in 0.1-m and 0.6-m depth
- Vapor pressure deficit (VPD) and reference evapotranspiration (ET0) (Allen et al. 1998)

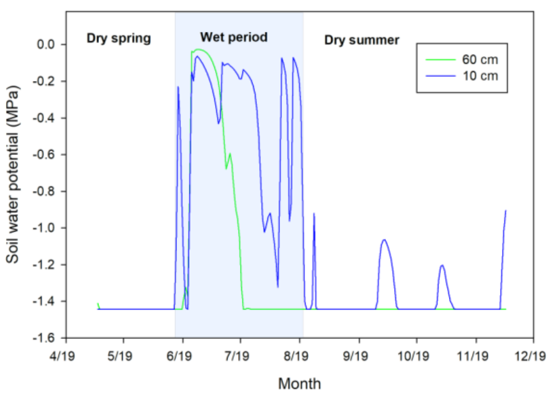

Fig. 1 Soil water potential in 0.1-m and 0.6-m depths

Table 1 Summary statistics of the mixed effect model on tree DBH (Intercept for the reference level – tree on mound; A = adjacent; N = non-adjacent tree).

Fixed effects:	Estimate	Std. Error	df	t value	Pr (>|t|)
(Intercept)	59.990	3.096	59.981	19.378	< 2e-16 ***
Position A	-6.363	2.562	142.338	-2.484	0.0142 *
Position N	-6.005	2.535	142.441	-2.369	0.0192 *

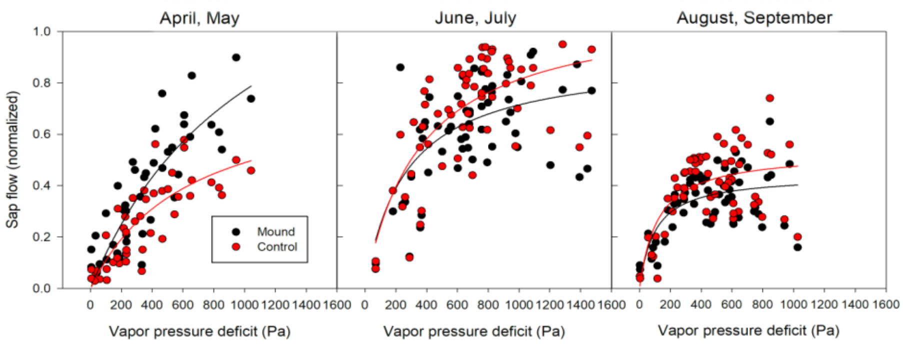

Fig. 2 Response of transpiration to vapor pressure deficit in the trees on mounds (red symbols / lines) and the control trees (black symbols / lines) in two dry (the left and right panel) and one wet period (central panel)

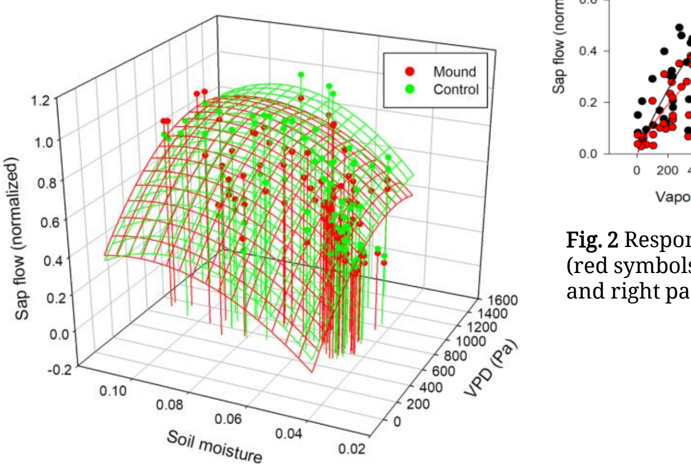

Fig. 3 Mutual responses of the sap flow in control trees (green) and the trees on mounds (red) to the volumetric soil moisture and VPD

RESULTS

TREE GROWTH

- Mixed effect model showed the significant effect of tree position on DBH (Table 1).
- Multiple comparisons confirmed the DBH was significantly lower in the adjacent trees, as compared to trees on mounds (p = 0.0390) and the marginally significant difference between trees on mounds and non-adjacent tress (p = 0.0535).

SAP-FLOW DYNAMICS

- The season 2019 split in the three periods, which differ in the availability of soil water (Fig. 1).
- The response of transpiration in April and May differed from the rest of the season (Fig. 2).
- Responses of sap flow to soil moisture and VPD revealed slightly higher sensitivity of stomatal regulation in trees on mounds (Fig. 3).

CONCLUSION

- Our results suggest the good availability of water for trees on mounds during spring, which then gets depleted later in the season.
- This may explain the relatively better growth of trees on mounds as compared to the neighboring trees of equal age.

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