Lethal effects of waterlogging on Scots pine appear with delay

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Introduction

A key question in peatland forestry in Finland deals with maintenance of ditch network. We expected that responses of Scots pine to elevated ground water table in the growing season appear with a delay.

Material and methods

- 7-years-old seedlings were waterlogged (WL) for 5 weeks in a root lab experiment that consisted of growth and dormancy phases (Fig. 1).
- WL with root zone O_2 content 0% started in the growth phase CS2 when shoot elongation was ending but trunk diameter growth was in progress (Fig. 1).
- Trunk sapflow, chlorophyll fluorescence and gas exchange of needles were monitored.

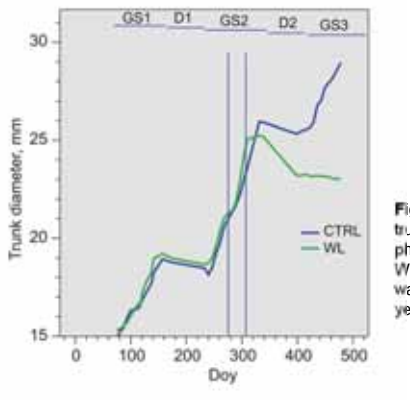

Fig. 1. The timing of WL (vertical lines) with trunk diameter growth in the second growth phase GS2. D1 and D2 are dormancy phases. WL and CTRL refer to waterlogged and non-waterlogged seedlings. Doy indicates day of year.

Results

- In trunk sapflow, first signs of decline were observed already after few days of WL (Fig. 2A).
- In needles, first signs of decline in photosynthesis machinery were observed after three weeks of WL (Fig. 2B, C, D, E).
- The timing of oxygen return to root zone after drainage seemed to be critical for survival; several WL-seedlings finally died in the post-treatment phase.

Conclusions

The rate of response to WL in the growing season was slow but once started the seedling responses were stronger than expected. This should be considered in planning peatland forestry operations.

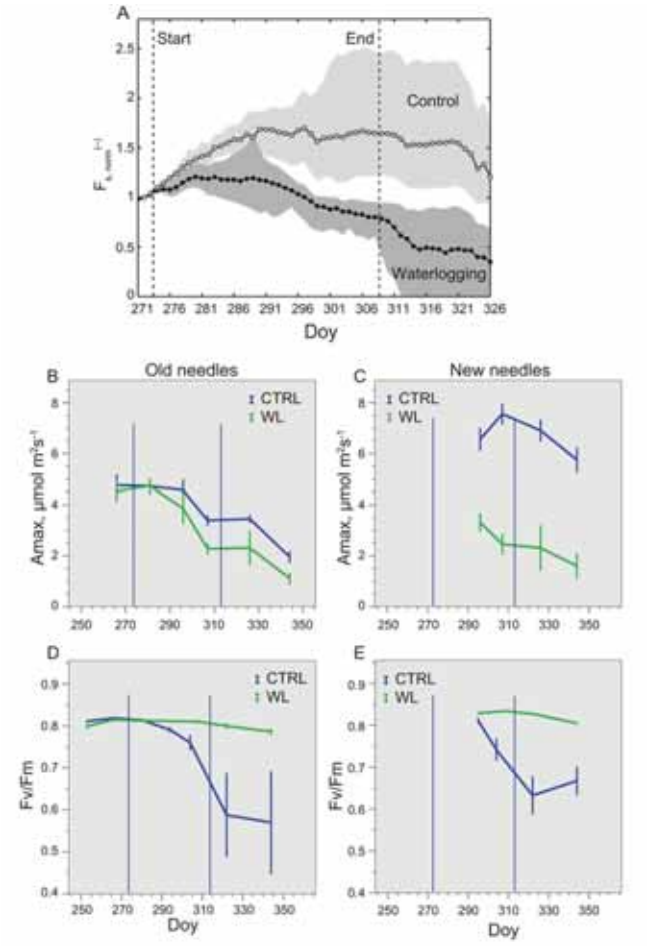

Fig. 2. Normalized trunk sapflow (A), light saturated assimilation (Amax) (B, C) and maximum photochemical quantum yield of PSII (Fv/Fm) (D, E) for old and new needles before, during and after waterlogging (WL) treatment. Vertical lines indicate WL period. Abbreviations as in Fig. 1. Bars indicate standard errors.

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