

The effect of drought on xylem formation in Norway spruce

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Background

- Extreme weather events, like summer drought, will increase in boreal region.
- Climate extremes with rising mean temperature may decrease the vitality of Norway spruce.
- Tree susceptibility to windstorm damages, insect attacks and pathogens may increase.
- Possible decrease of timber production?

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Aim

- to study the effects of artificial drought on growth rate, wood density and tracheid properties of mature Norway spruce,
- to find out whether nutrient availability affects the drought-sensitivity.

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Material & methods

- Drought and control treatments on fertilised and non-fertilised plots: D₀F₀, D₁F₀, D₀F₁ and D₁F₁
- Two sites in southern Finland, 40 trees
- Radial and vertical growth, wood density, and tracheid dimensions



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Results

Drought significantly reduced the tree growth rate:

- height growth by 23–31%
- radial growth by 15–19%
- the number of tracheids by 14–29%
- latewood proportion by 3–11%.

Drought had small influence on tracheid properties:

- increased the diameter of earlywood tracheids by 2–5%
- decreased the diameter of latewood tracheids by 7%–23%
- increased cell wall thickness by 3–8%, especially in latewood
- increased the proportion of cell walls within rings by 6–18%

Drought slightly increased wood density:

- mean, early- and latewood density, minimum and maximum density slightly by 0–8%

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Conclusions

- Drought decreased the annual radial and height growth.
- Drought had a small influence on tracheid properties and wood density.
- No differences in drought-sensitivity between fertilised and unfertilised trees.

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