Stomatal regulation across tree species as a window into water-use strategies under climate change

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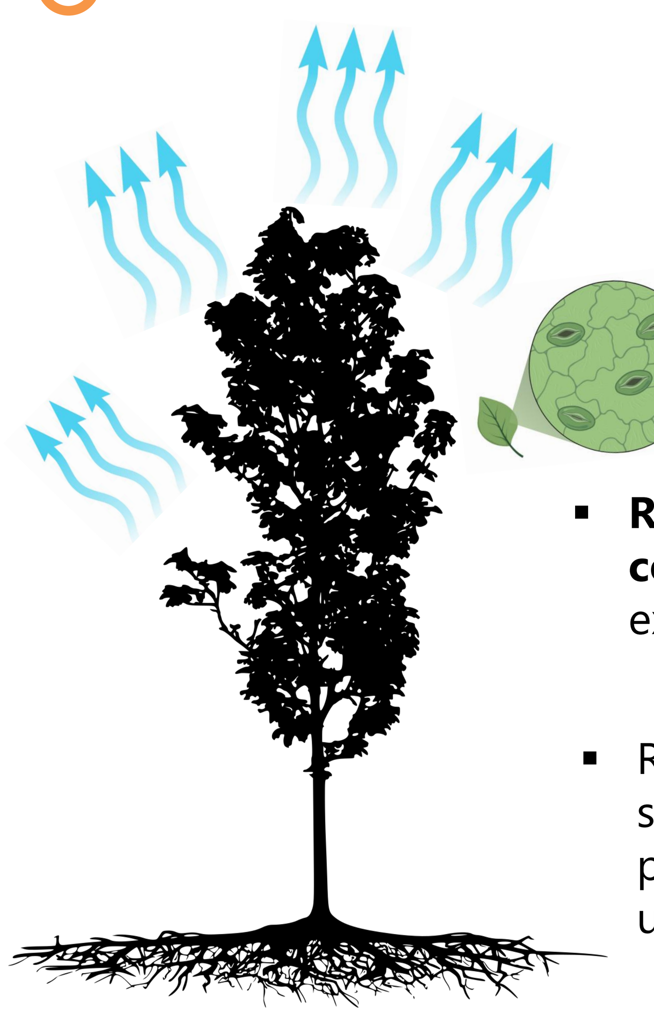
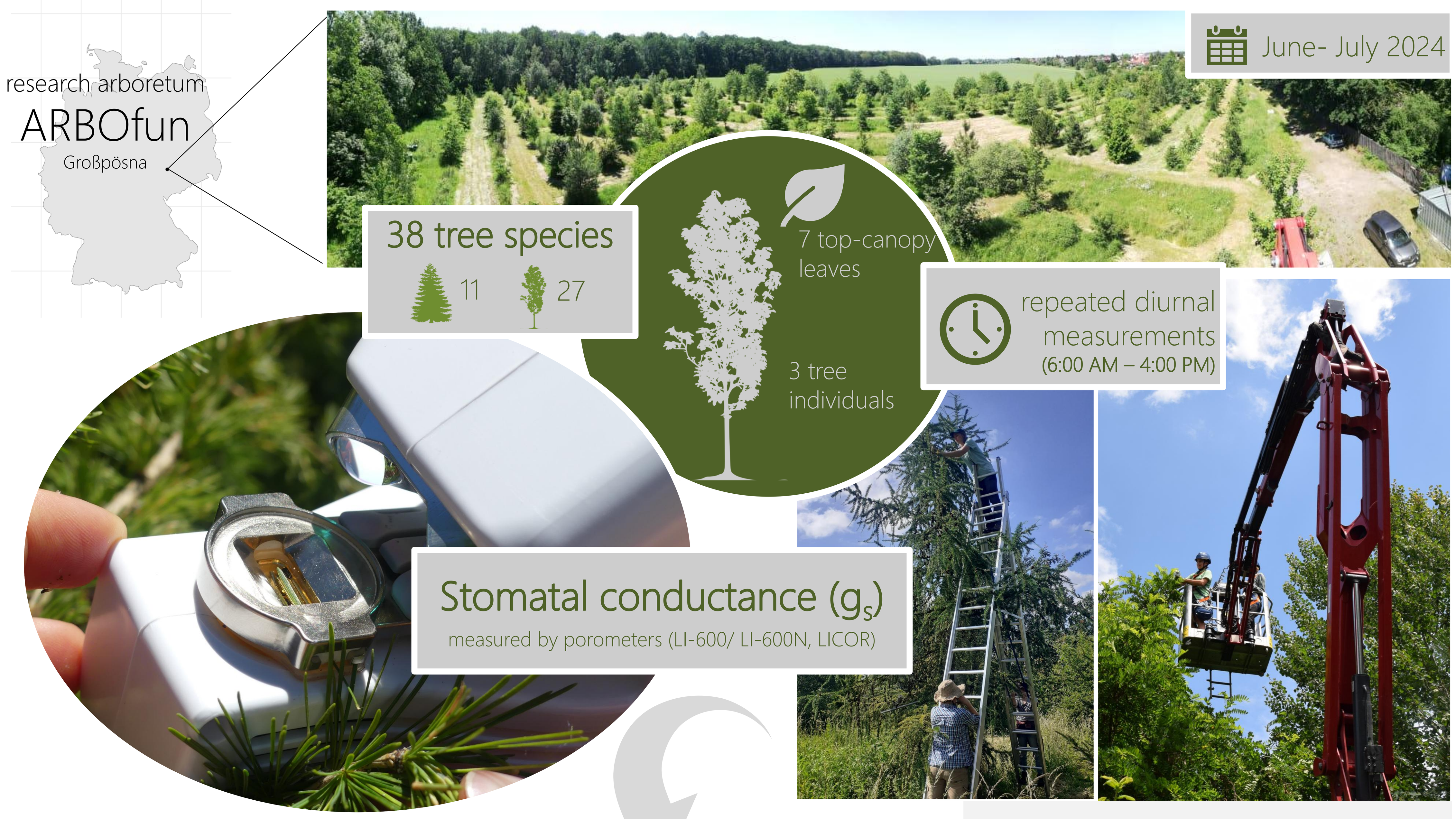
INTRODUCTION

- Climate change intensifies **droughts and heatwaves** → tree growth decline and mortality



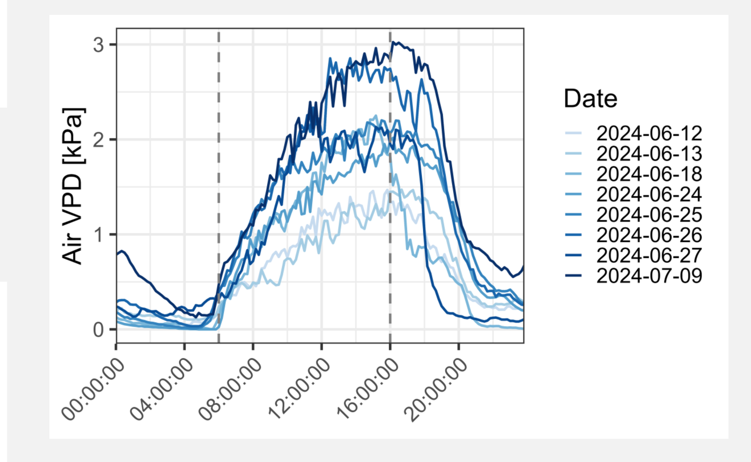
- For predicting forest vulnerability → understanding **tree water-use strategies**.
- **Regulation of stomatal conductance** prevents excessive water loss
- Research gap: stomatal regulation patterns **across species** under **shared conditions**

METHODS



Modeling g_s, as a function of vapour pressure deficit (VPD):

$$g_s = a \times VPD^k \times e^{-b \times VPD}$$



FIRST RESULTS

Stomatal sensitivity highlights a **continuum of drought strategies** between **"tolerators"** and **"avoiders"**

→ From high VPD tolerance with prolonged carbon gain to early closure, prioritizing water conservation

Extracting species-specific **proxies of stomatal sensitivity** under atmospheric dryness

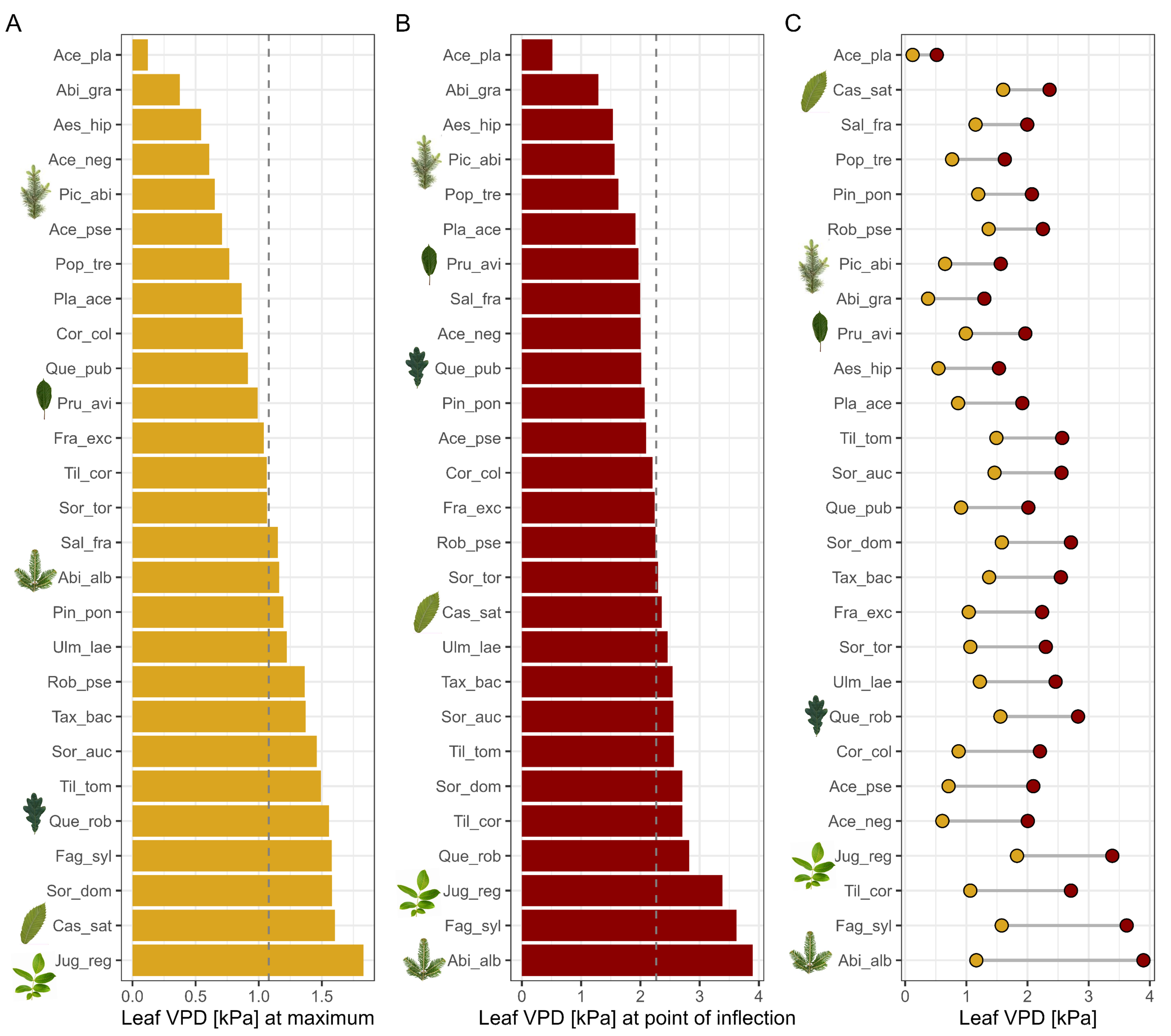


Fig. 1: Tree species ranking for (A) leaf vapour pressure deficit (VPD) at maximum g_s (B) leaf VPD at point of inflection of the g_s–VPD curve (see Fig.2), and (C) the distance in leaf VPD between the leaf VPD at maximum and the leaf VPD at the inflection point.

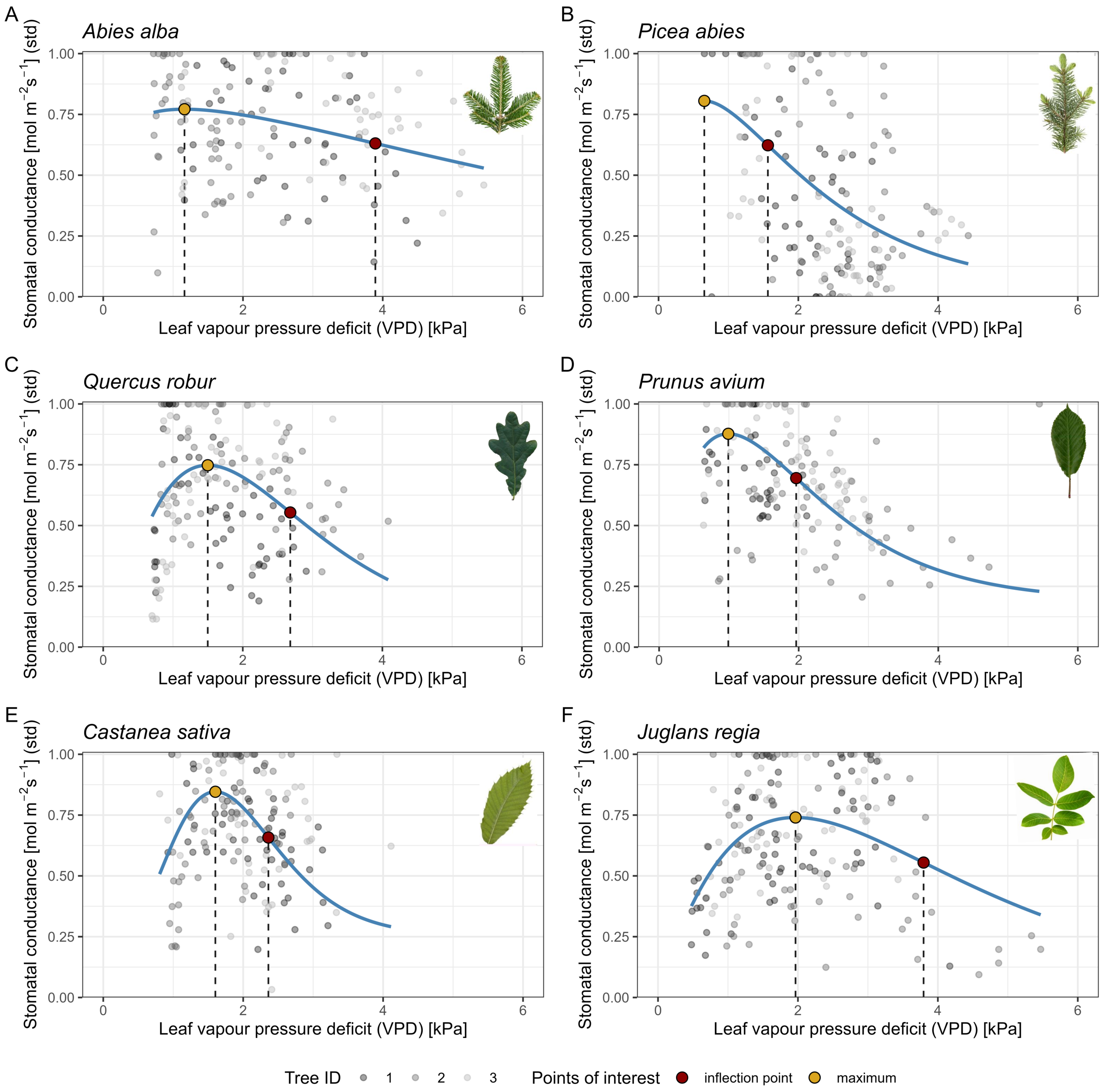
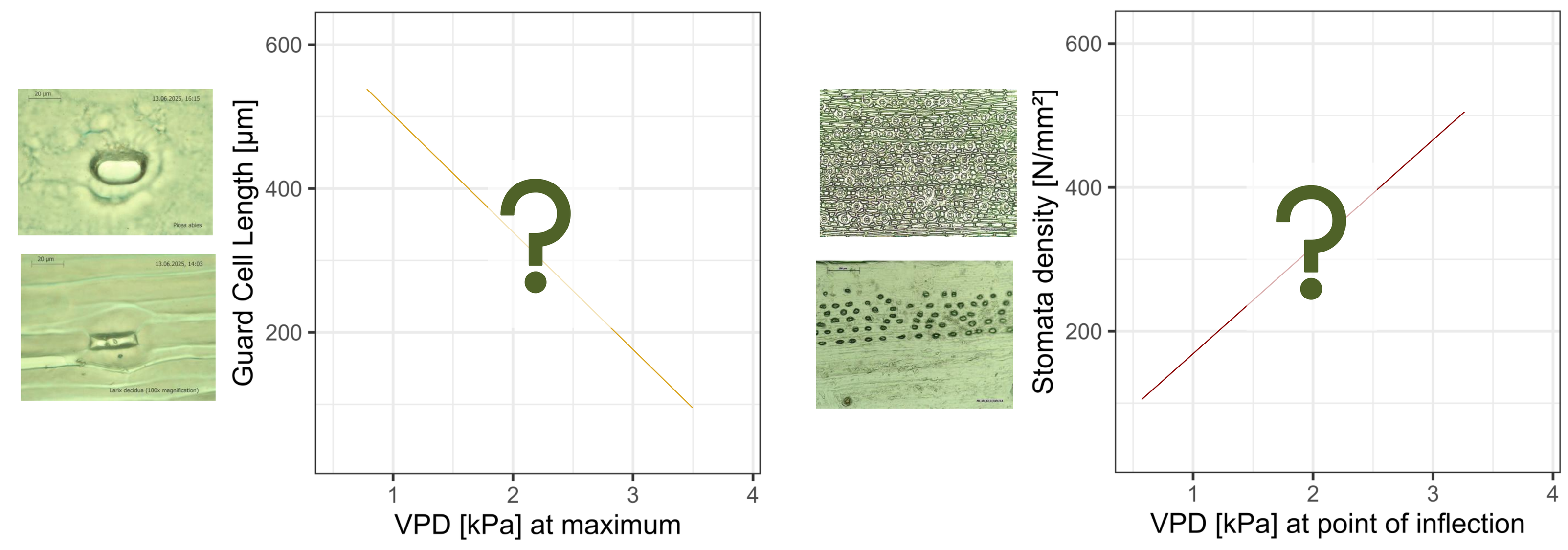


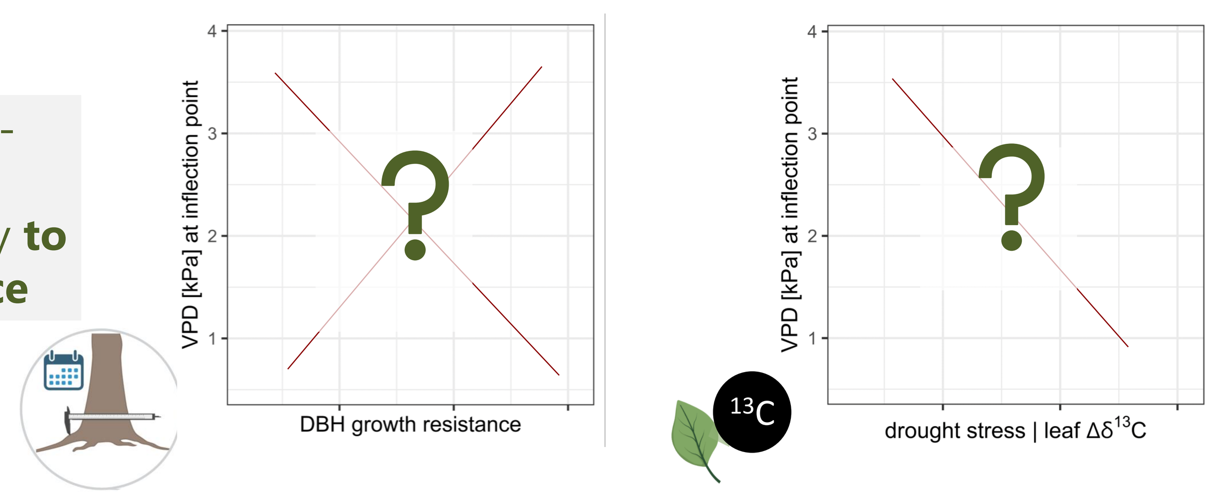
Fig. 2: Stomatal conductance (g_s) as a function of leaf vapour pressure deficit (VPD).
Model fitted as $g_s = a \times VPDk \times e^{-b \times VPD}$, while correcting for ambient light as covariate and accounting for nested random effects of leaf ID within tree ID. The yellow point on the curve indicates the predicted maximum g_s, the red point on the curve indicates the predicted inflection point of the curve. Grey colours indicate different tree individuals.

NEXT STEPS

Relate the species-specific proxies of stomatal sensitivity **to stomata density and size** and other leaf traits



Relate the species-specific proxies of stomatal sensitivity **to drought resistance**



DFG Deutsche Forschungsgemeinschaft

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Many thanks to all the dedicated helpers whose energy and commitment made this field campaign a success!
Anja Kahl, Melanie Hanfstängel, Carolin Hensel, Jessica Esser, Annalena Lenk, Michèle ter Huurne, Tom Künne, Jori Marx, Nicole Nabel, Greta Zahner, Jonas Pohlmann, Julia v. Braack, Lina v. Wedel