

To grow or not to grow? – Tree growth within Flemish Agroforestry Systems

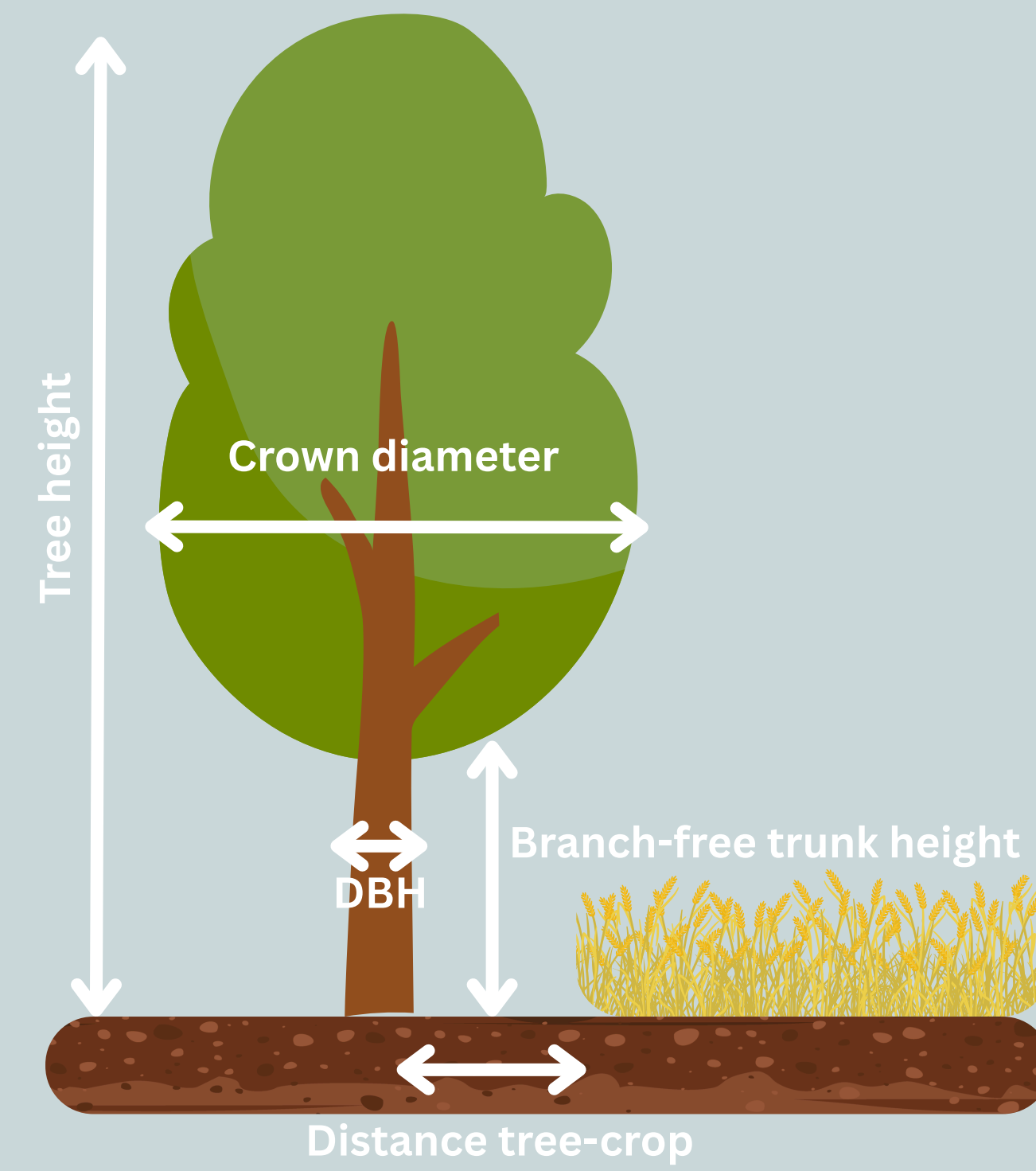
Liselot De Praetere^{1,2,3}, Bas Verleyen¹, Liselot Derideaux¹, Paul Pardon², Bert Reubens², Annemie Elsen³, Tom Coussement³, Kris Verheyen¹

¹ Ghent University, Lab of Forest and Nature (ForNaLab), ² Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), ³ Soil Service of Belgium (BDB)

Introduction

Agroforestry is a nature-based solution holding significant potential for **increasing agricultural sustainability and resilience**, among others by **storing carbon**. However, quantifying the carbon storing potential within agroforestry is challenging due to **geographical limitations and generic tree growth models** without field validation, often based on forest growing conditions [1,3,4]. The **lack of calibrated data of various soil types** and tree growth curves adapted to agroforestry conditions therefore limits the reliability of **carbon storage modelling** within agroforestry systems [2,4].

Methodology



Tree species

Quercus spp., *Populus x canadensis*, *Prunus avium*, *Juglans regia*

Soil classes

L: loam; M: sandy loam; H: loamy sand; VH: sand

Agroforestry designs

Young alley cropping (AC) & older boundary planted (BP) agroforestry designs

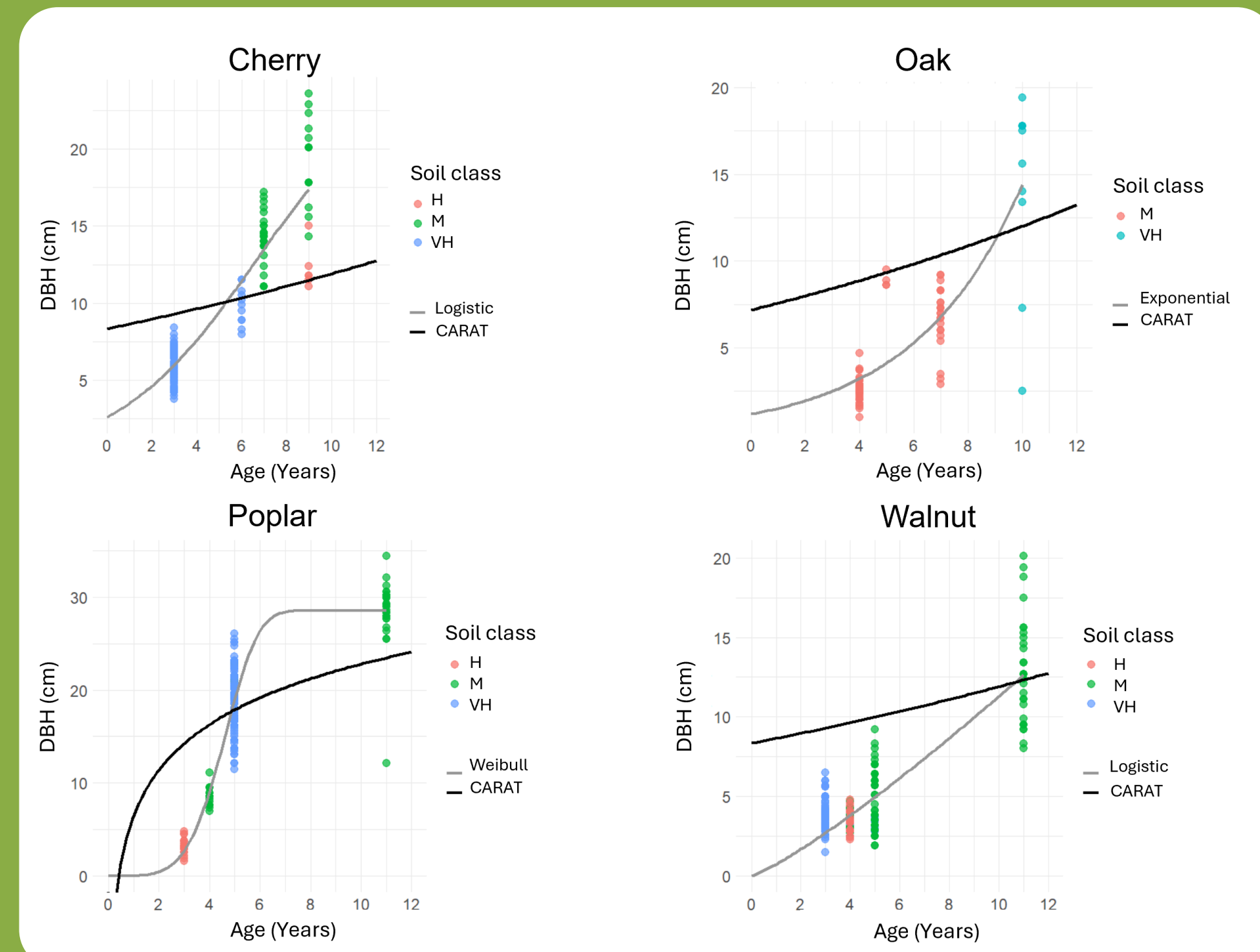
Management & Age

AC: Vitality scoring + tree damage

BP: Increment cores + trunk quality scoring

Results

Adapted growth curves for young alley cropping AF improve DBH growth estimations in CARAT



Author: Liselot Derideaux (2026)

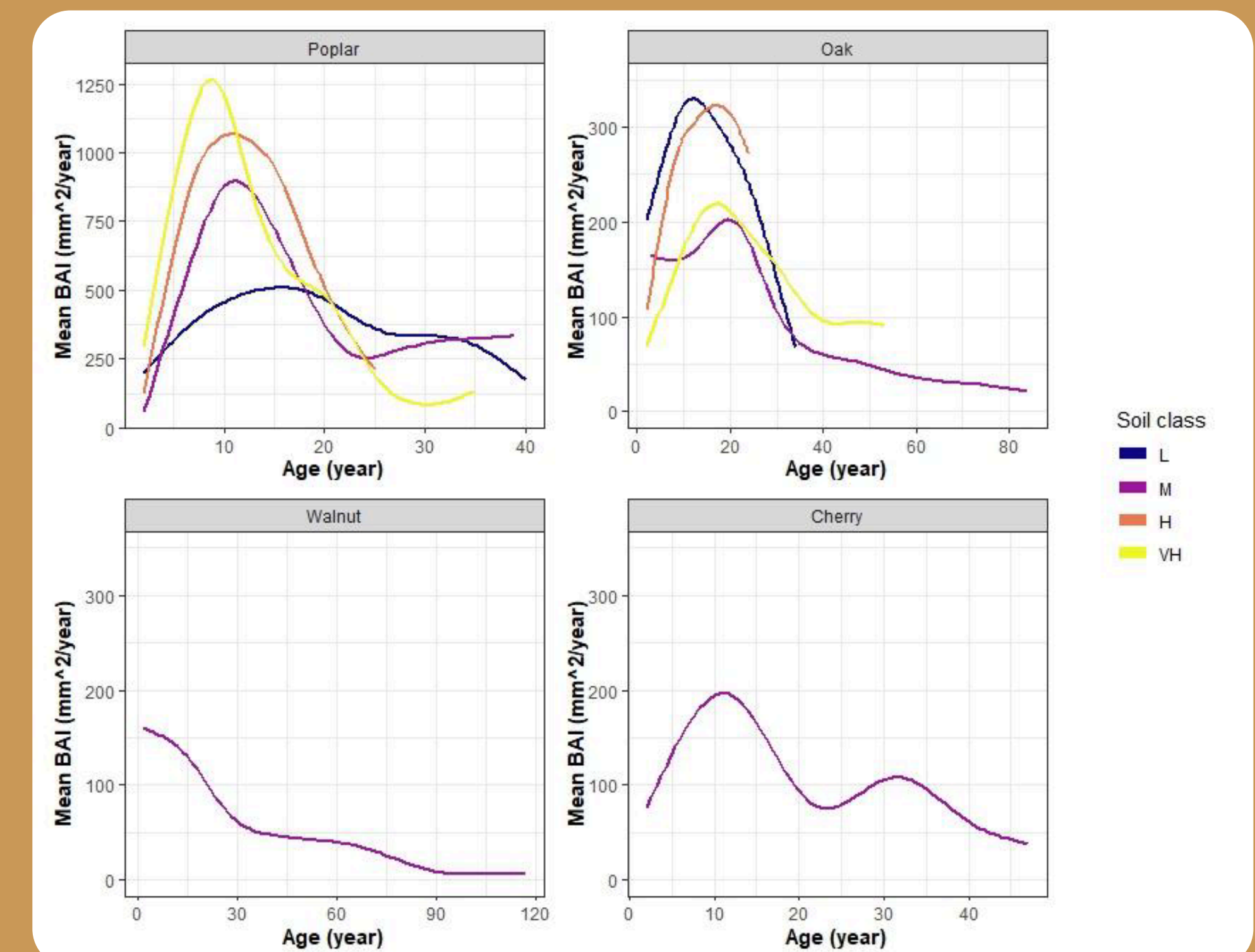
What about CARAT?

- Soil type influences young tree growth in AC
- Adapted DBH growth curves for young trees improve accuracy of CARAT (current growth curves: based on older trees)

Soil class & tree growth?

- Clear visual MBAI peak for poplar, oak & cherry, absent for walnut
- Influence of soil class on visual MBAI strongest present for poplar (soil classes VH & L) and oak (soil classed L & M)
- Soil classes with high maximal MBAI = early peak
- Soil classes with low maximal MBAI = late peak
- MBAI development with age differs significantly among soil classes ($p < 2e-16$)

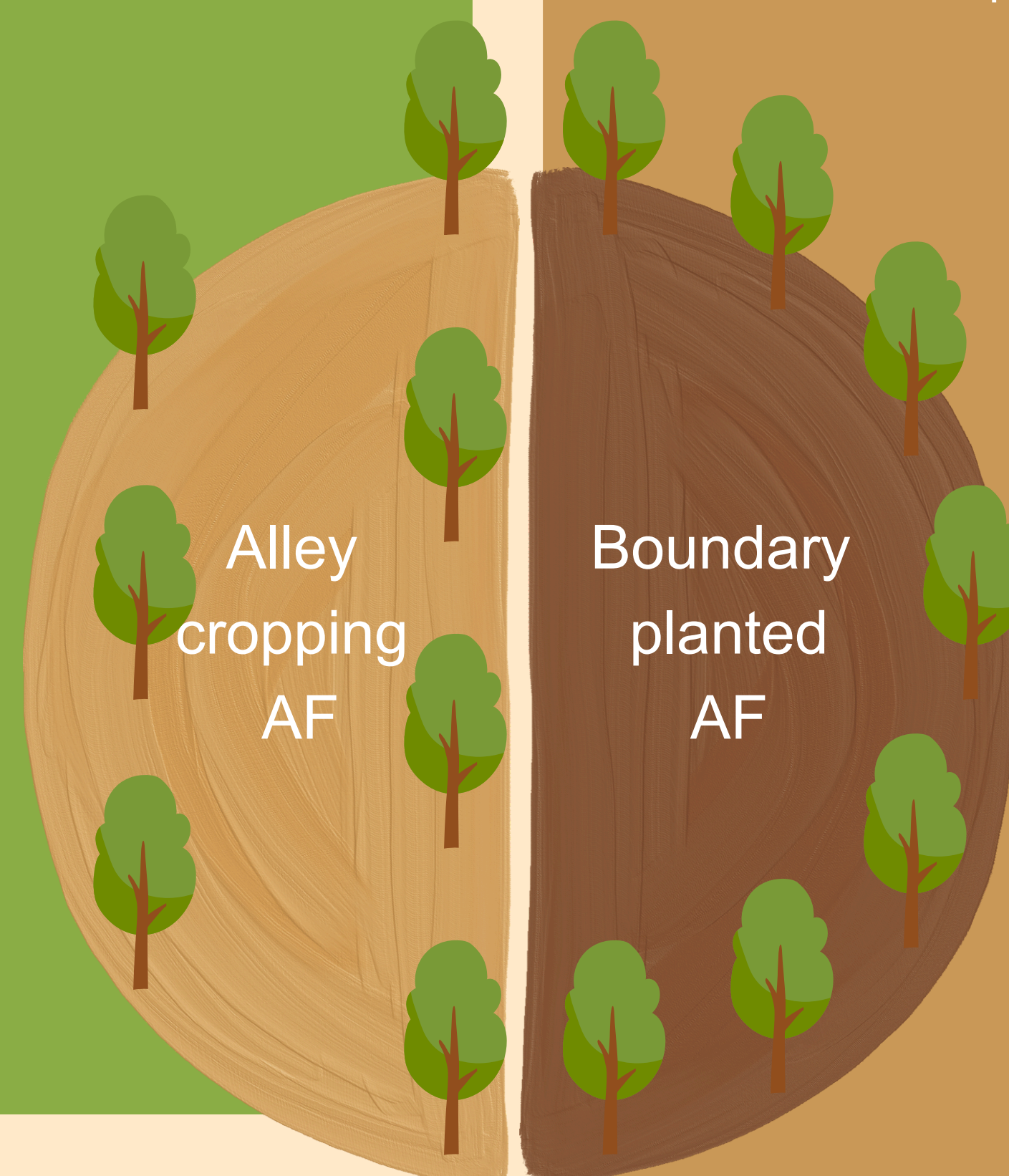
Soil class influences MBAI development through age



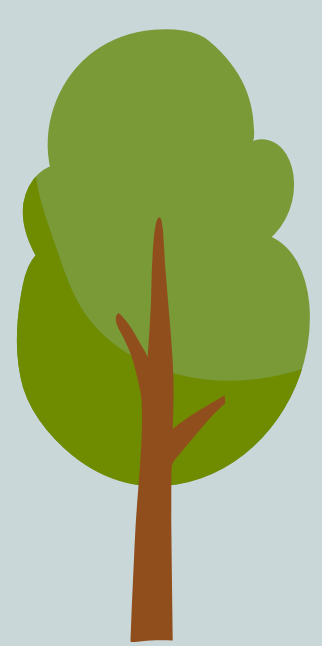
Author: Bas Verleyen (2026)

Tree vitality?

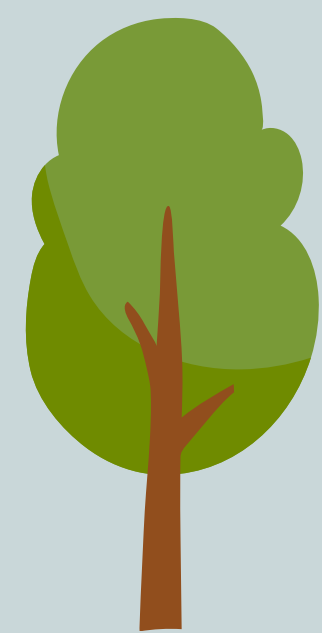
- Mechanical damage was the most occurring cause of damage within young AC
- Mechanical damage results in lower DBH growth & lower tree vitality
- Walnut vitality highly suffered due to damage



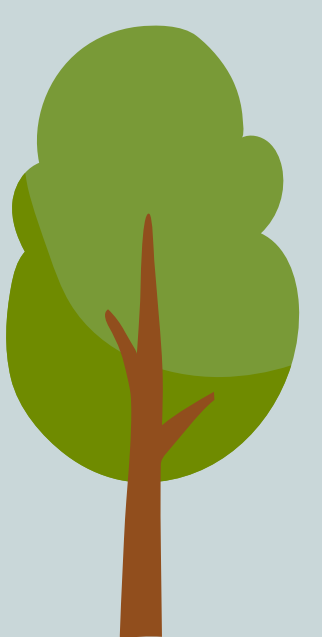
Take-home



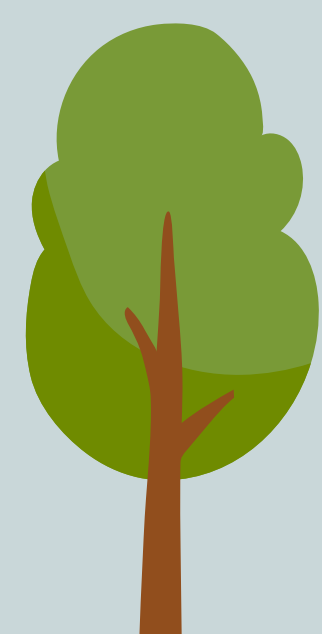
Soil type influences MBAI development with age & tree species



Including soil type improves DBH estimations in CARAT

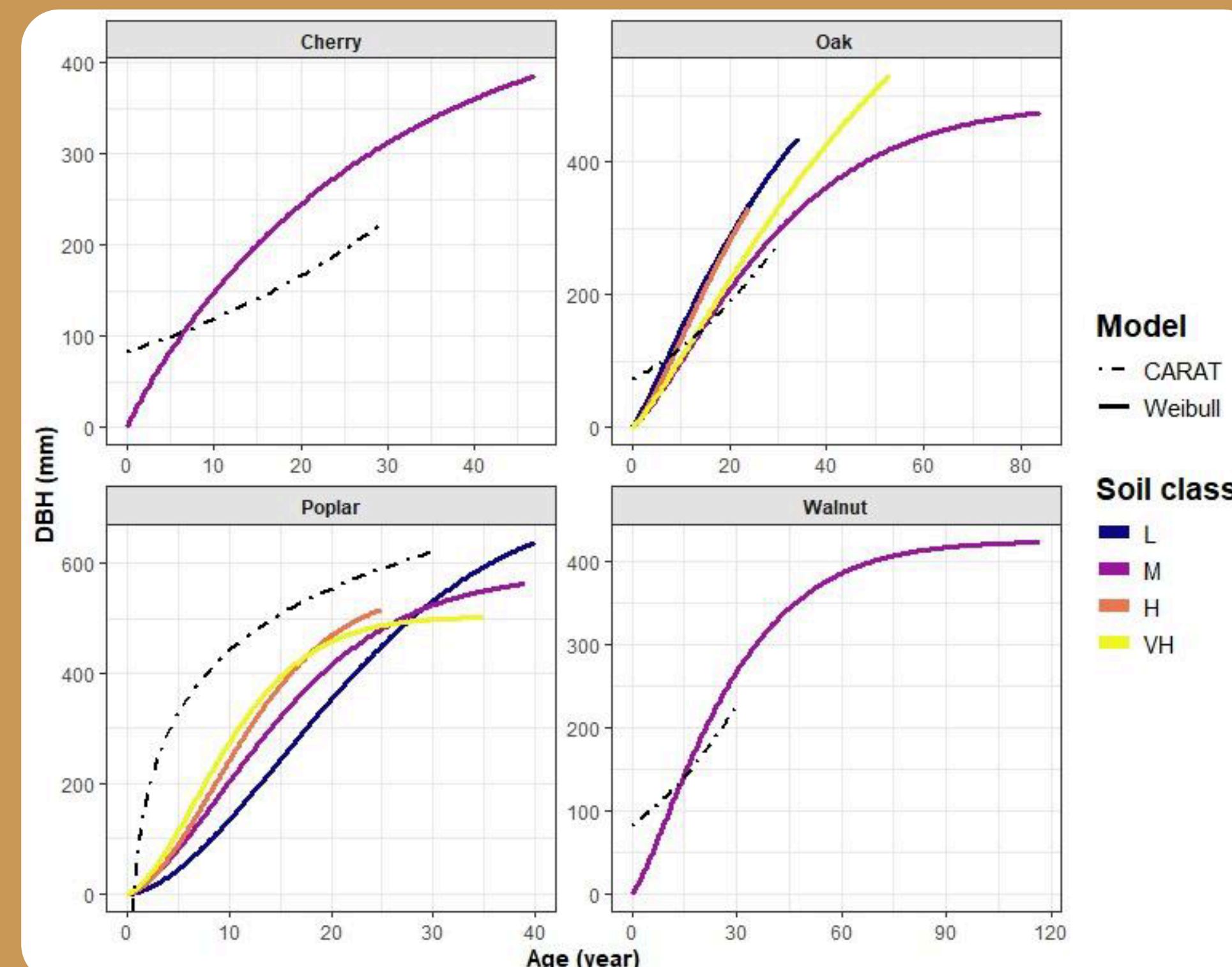


Mechanical damage in young AC results in lower tree vitality & DBH growth



Implementing adapted growth curves improves DBH estimations in CARAT

Soil class improves DBH growth curves in CARAT for boundary planted AF



Author: Bas Verleyen (2026)

What about CARAT?

- Including soil classes improves diameter growth estimations substantially
- New ecologically fitting growth equations predict DBH growth more accurately
- **! Precaution !** Pruning intensity, irrigation & management history were not included but might contribute to growth variability

References

1. Kraft et al. (2021). *Agron.*, 11(11), 2106. <https://doi.org/10.3390/agronomy11112106>
2. Laub et al. (2025). *Agrofor. Syst.*, 99, 25. <https://doi.org/10.1007/s10457-024-01127-y>
3. Sollen-Norrlin et al. (2020). *Sustainability*, 12(17), 7001. <https://doi.org/10.3390/su12177001>
4. Vanneste et al. (2025). *Agrofor. Syst.*, 99, 68. <https://doi.org/10.1007/s10457-025-01162-3>

