Taper and total aerial volumes

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1. Taper volume

Single-variable and three-variable models

In tree sample...

- trees j, where c, h, h_{dec} are measured

$$V_{\text{bole}}(j) = f_{III}(c, h, h_{\text{dec}})$$

- *simplified* or *remeasured* trees i, where c is measured

$$\cancel{V_{\text{bole}}(i) = V_{\text{bole}}(j)} \rightarrow \cancel{V_{\text{bole}}(i) = V_{\text{bole}}(j)\frac{c(i)}{c(j)}} \rightarrow V_{\text{bole}}(i) = V_{\text{bole}}(j)\frac{f_I(c(i))}{f_I(c(j))}$$

What we keep

- Data sets source
- Linear models
- Transformations

$$\begin{cases} V_{\text{bole}} = \dfrac{c^2 h}{4\pi \left(1 - \frac{1{,}3}{h}\right)^2} f_{\text{new}} \\ f_{\text{new}} = f_{III}(c, h, h_{\text{dec}}) \end{cases}$$

$$\ln(V_{\text{bole}}) = f_I(\ln(c))$$

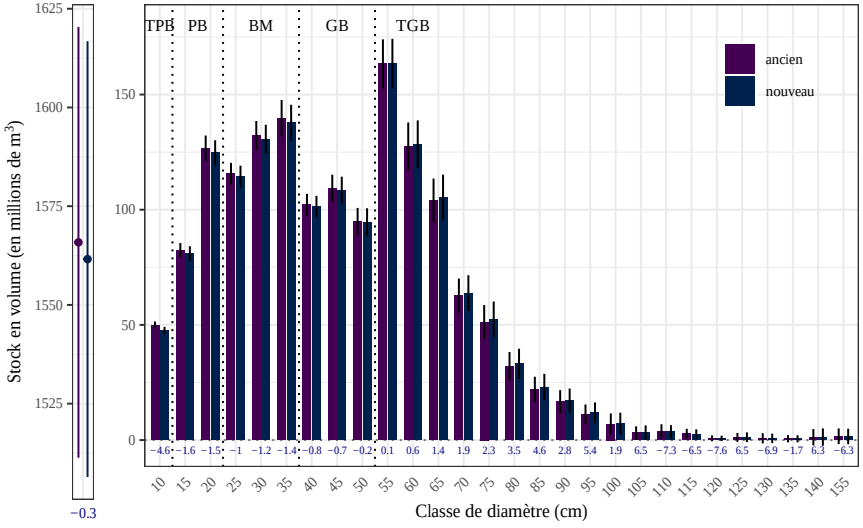
What we change

- Explanatory variables
  - h_{dec} turns into h'_{dec}
  - variables are shared by every species
  - $f(g)$ is dropped
- Parameters
  - the three-variable model is no longer cut-specific

$$f_{\text{new}} = \alpha + \beta c + \gamma \frac{\sqrt{c}}{h'_{\text{dec}}} + \delta \frac{\sqrt{h'_{\text{dec}}}}{c^2 h} + \eta \left(1 - \frac{h'_{\text{dec}}}{h}\right)$$

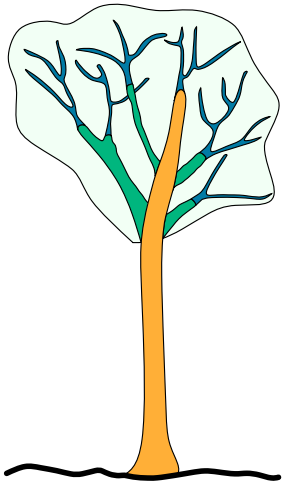
$$V_{\text{bole},I} = \mathrm{e}^{\alpha + \beta \ln(c) + \gamma \ln(c)^2 + \frac{\sigma^2}{2}}$$

Performances similar to current models



2. Total aerial volume

A tree in Emerge data

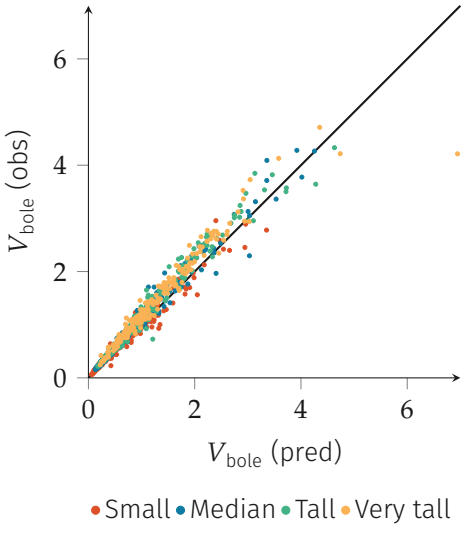


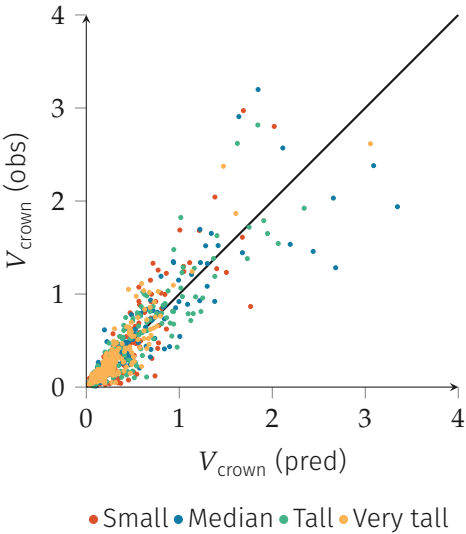
- Bole volume
- Large branches
- Small branches

Three paths

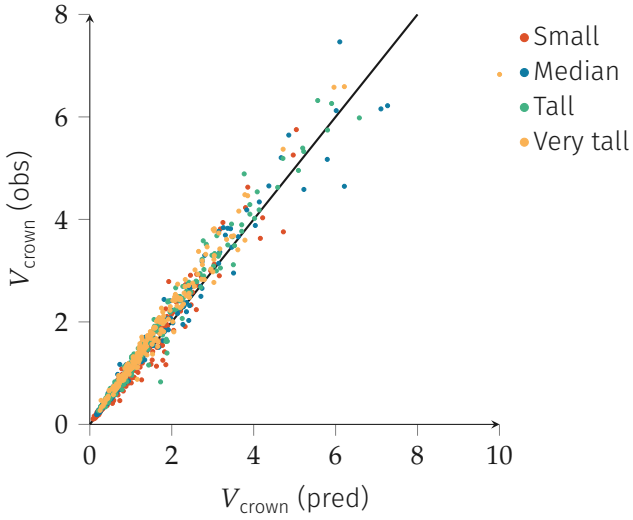
1. Bole volume (Florence) and independent crown model
2. Multivariate model for both bole and crown
3. Model on the ratio between bole and total volume

Independent crown model – 1





Independent crown model – 2



Multivariate model

Ratio model

3. Conclusion

Sum-up

Figure that sums up everything!