Mura M, Mura M, Scotti R (2025). **Evaluation of methods to improve the direct estimation of standing trees volume**
iForest – Biogeosciences and Forestry – doi: 10.3832/ifor4670-018

Supplementary Material

Tab. S1 - Statistics used to compare the models.

Statistics	**Equation**
Mean Absolute Error	$MAE = \frac{1}{n}\sum_{i=1}^{n}\left\|Y_i - \hat{Y}_i\right\|$
Coefficient of determination	$R^2 = 1 - \frac{\sum_{i=1}^{n}\left(Y_i - \hat{Y}_i\right)^2}{\sum_{i=1}^{n}\left(Y_i - \bar{Y}\right)^2}$
Root mean square error	$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(Y_i - \hat{Y}_i\right)^2}$
Percent relative bias	$PRB = 100\frac{\sum_{i=1}^{n}\left(Y_i - \hat{Y}_i\right)}{\sum_{i=1}^{n}\hat{Y}_i}$

Y_i= reference volume of the *i-th* trees, obtained by accurate measures

$\hat{Y}_i$ = volume of the i-th tree, obtained by a quick volume estimation method

$\underline{Y}$= mean of the reference volumes

n= total number of observations

Fig. S1 - Scheme of the detailed measurement of a felled tree. IDpalco_sotto = lower branch, IDpalco_sopra = upper branch, hsez_sotto = height of the lower section, d_sez = diameter of the section, last cilin. = last cilinder, h_ipso = height of the standing tree, lungh_Abbattuto = length of the felled tree without stump.

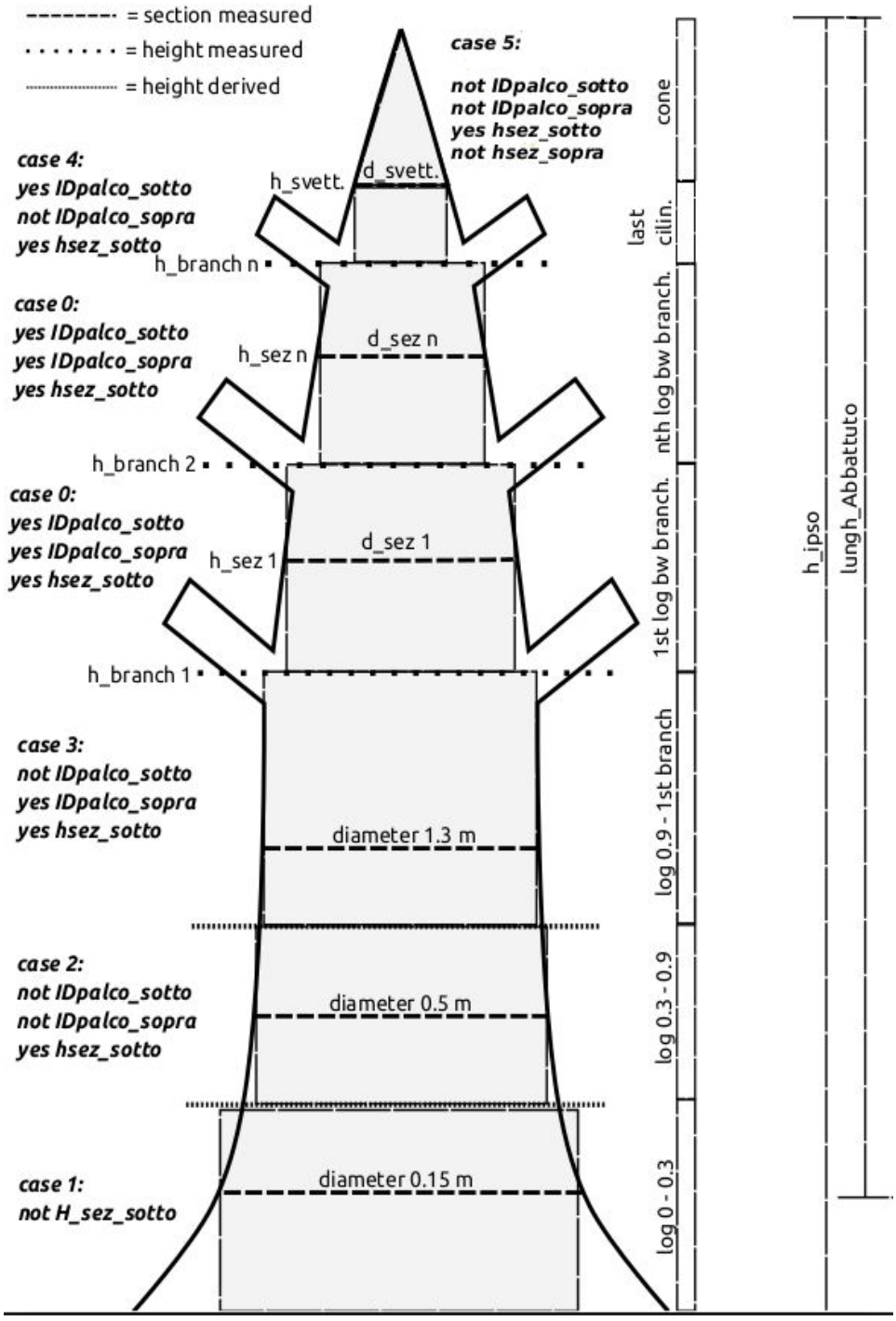


Fig. S2 - Comparing the height estimated by the hypsometer on the standing tree to 'height' measured as the length of the felled tree.

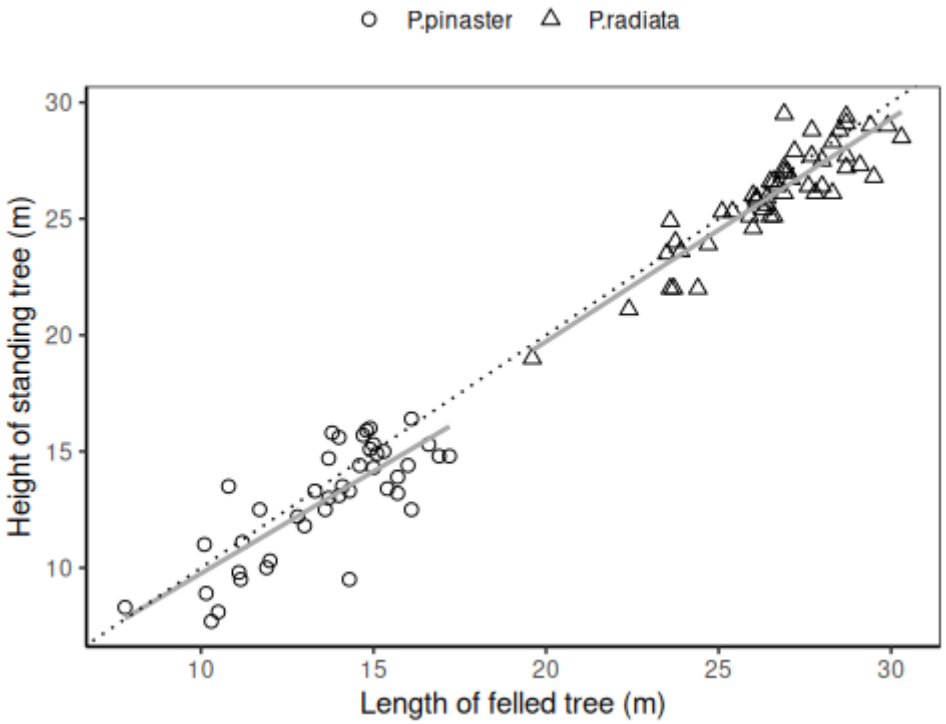
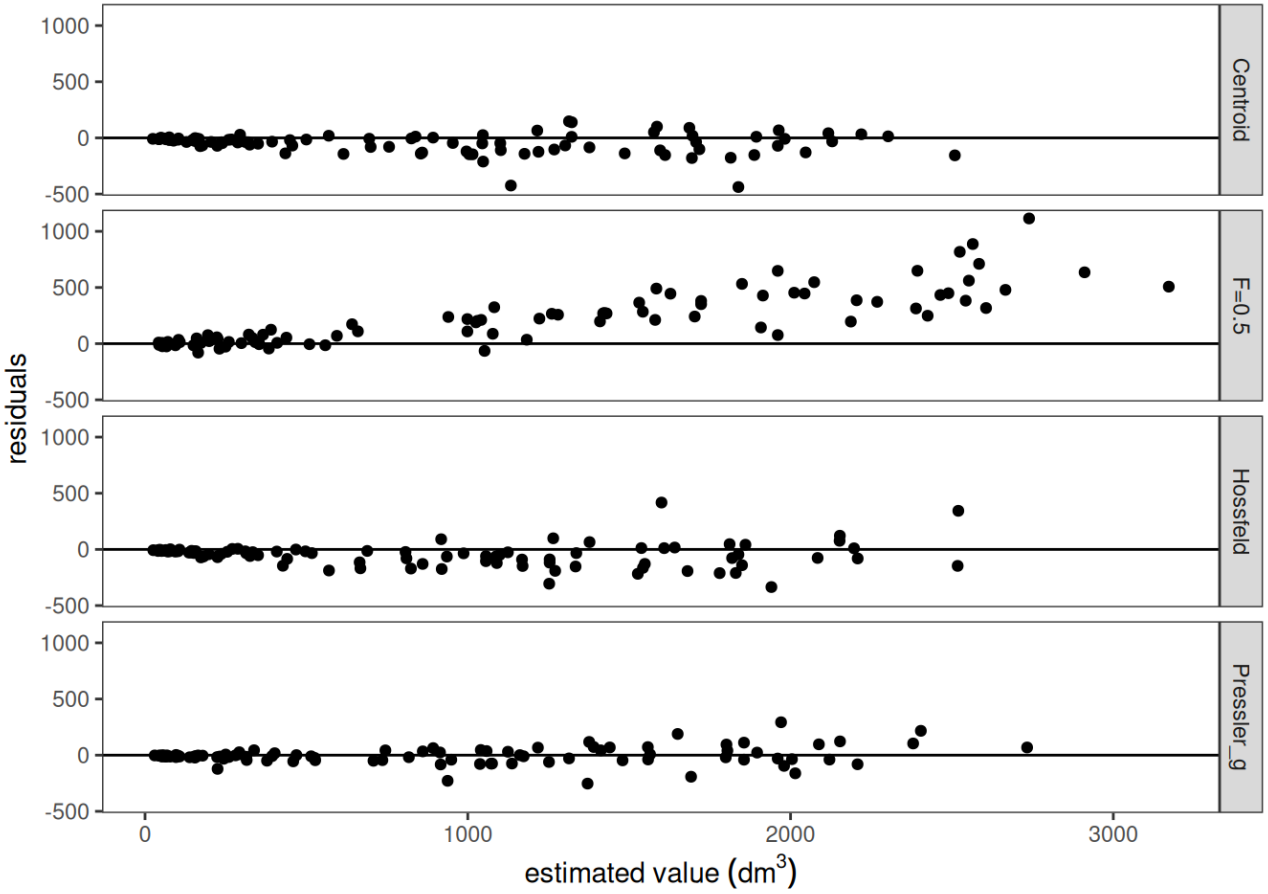


Fig. S3 – Plot of residuals.



Tab. S2 - Paired value t-test matching height estimated by the hypsometer on the standing tree to 'height' measured as the length of the felled tree.

Species	difference	p.value	df	conf.low	conf.high
P. pinaster	-0.690	0.005	41	-1.166	-0.215
P. radiata	-0.547	0.000	49	-0.833	-0.261