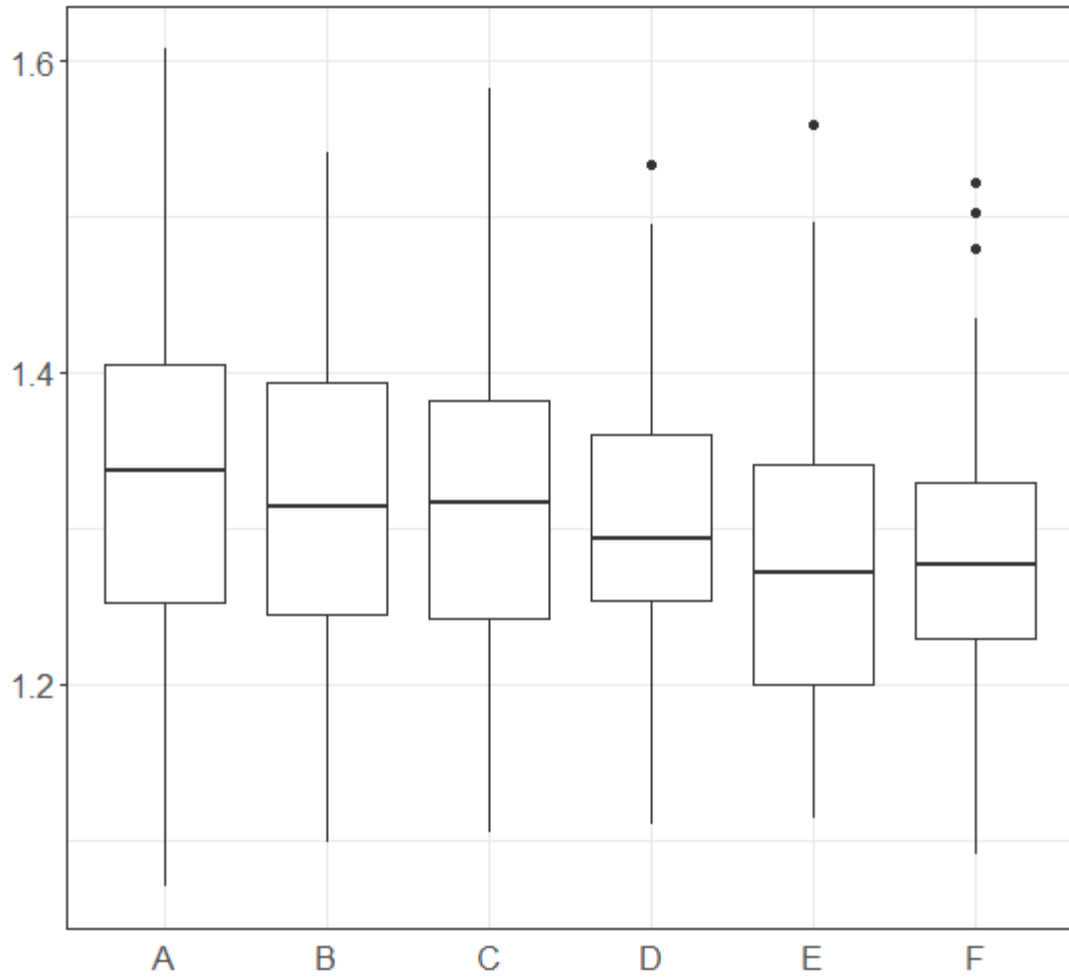**Figure S1.** Distribution of *Pinus halepensis* Mill. in Murcia (**a**) and (**b**). The study area (1,437.2 ha), mostly within Los Cuadros, is covered by *P. halepensis* forest. Map of the study area (**c**) showing the distribution of the 47 plots used in the study and the thinning square area is indicated by yellow line.

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Figure S2. Variable importance classification of the non-collinear selected variables. Label legends according to Table 2: variables selected to perform model predictions A to F.
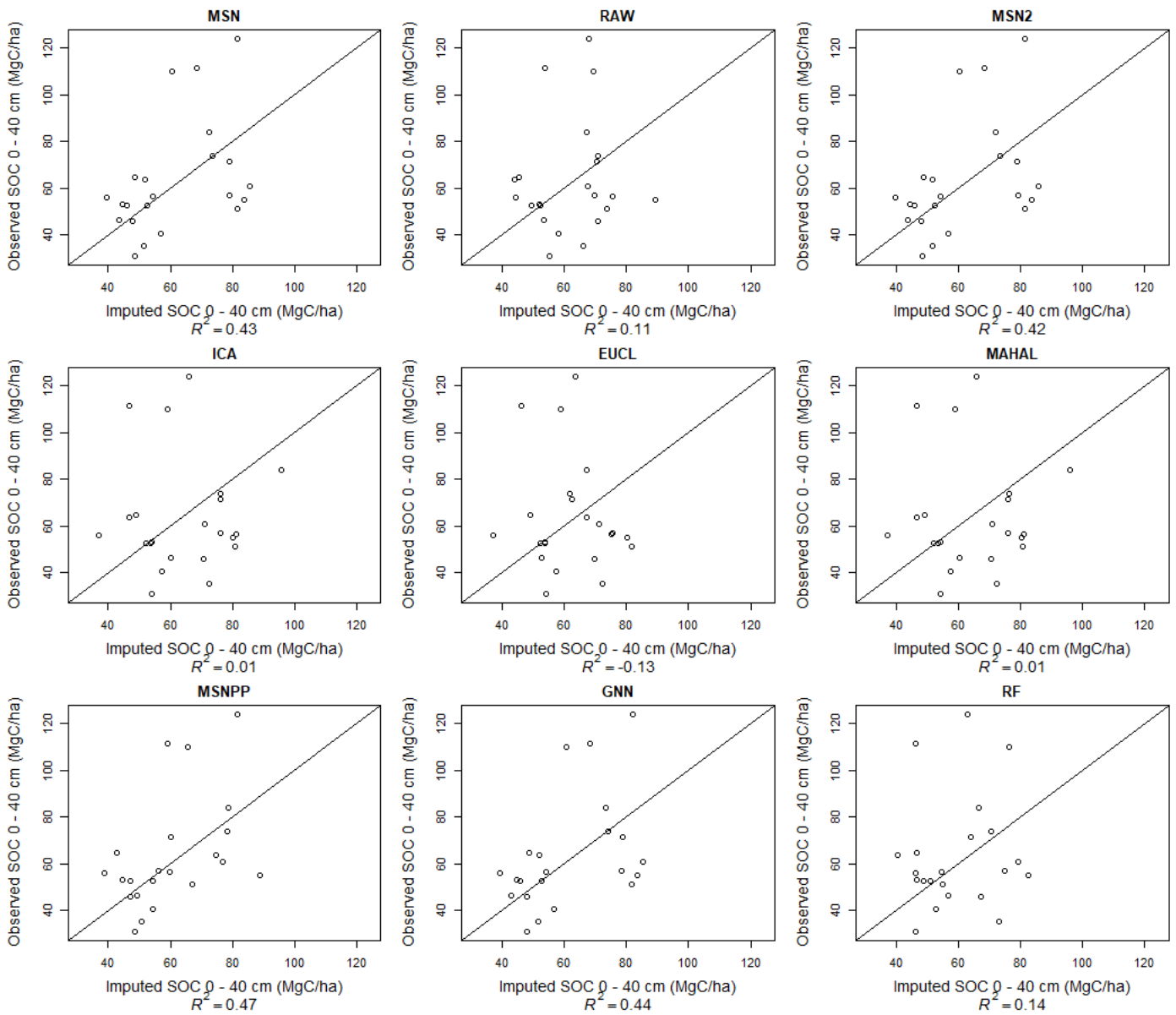
Figure S3.- Bivariate relationships between the LiDAR metrics and SOC$_{40}$ (0–40 cm soil layer) C stock of *Pinus halepensis* plantations at Los Cuadros (Murcia, Spain). In all figures the linear 1:1 line has been fitted. For these equations the R^2 value is included (see Table 3 for RMSE values).
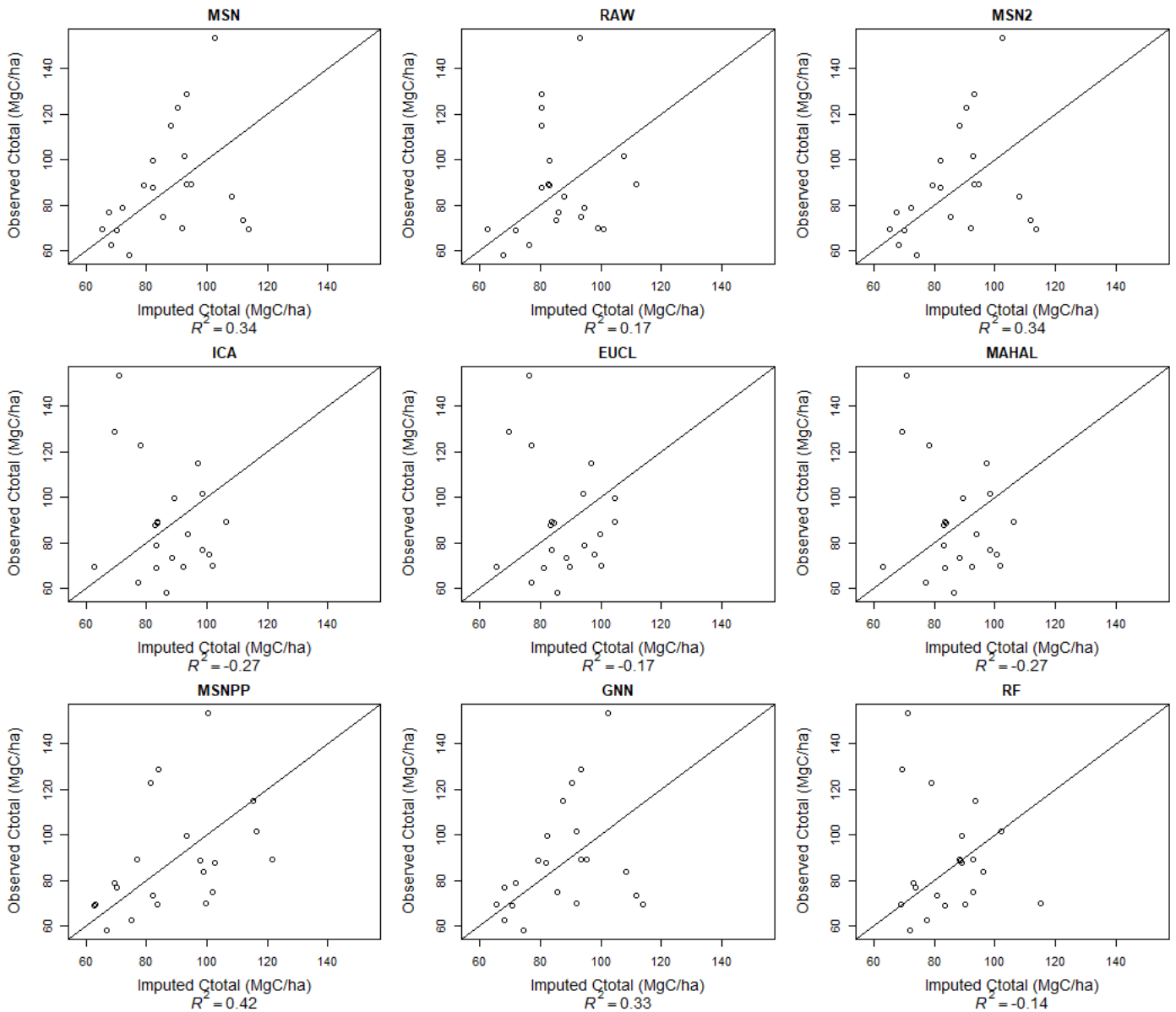
Figure S4.- Bivariate relationships between the LiDAR metrics and biomass + SOC$_{40}$ (0–40 cm soil layer) C stock of *Pinus halepensis* plantations at Los Cuadros (Murcia, Spain). In all figures the linear 1:1 line has been fitted. For these equations the R^2 value is included (see Table 3 for RMSE values).

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Table S1. Silvicultural characteristics of the inventory plots (N = 83) used in LiDAR models of carbon stocks of *Pinus halepensis* plantations at Los Cuadros (Murcia, Spain, see Fig. S1). Variables and abbreviations: stem density (D); height (H); diameter at breast height (dbh); basal area (G); overall biomass (Wt).

	Min	**Max**	**Mean**	**SD**
D (trees ha^{-1})	135.57	2933.72	1053.22	677.20
H (m)	1.35	37.39	22.00	8.67
dbh (cm)	9.79	19.96	15.37	3.73
G (m^2 ha^{-1})	2.48	9.11	4.71	1.58
Wt (Mg ha^{-1})	2.28	106.86	34.55	20.28

Table S2.- Correlation coefficients describing the strength of the linear relationships between the stand metrics (mean height, mean diameter, basal area, stand density, and biomass) obtained with LiDAR and the measured stand metrics.

	Height	Diameter	Basal Area	Density	Biomass
LiDAR height percentiles					
H10	0.21	0.08	0.14	0.04	0.18
H20	0.19	−0.15	0.04	0.19	0.08
H25	0.32	−0.11	−0.08	0.06	0.04
H30	0.34*	−0.09	−0.05	0.05	0.08
H40	0.40*	0.01	0.00	−0.01	0.17
H50	0.52***	0.13	−0.02	−0.14	0.24
H60	**0.84***	0.17	0.16	0.00	0.58***
H70	0.82***	0.17	0.17	0.05	0.58***
H75	0.81***	0.17	0.20	0.07	**0.59***
H80	0.78***	0.21	0.18	0.03	0.57***
H90	0.74***	0.22	0.12	−0.03	0.53***
H95	0.68***	0.22	0.08	−0.08	0.47***
H99	0.63***	0.27	0.04	−0.16	0.43**
Other LiDAR metrics					
Elev. Kurtosis	−0.34*	−0.12	−0.21	−0.15	−0.30
Elev. skewness	**−0.47***	−0.07	−0.20	−0.19	−0.33
Elev. CV	−0.42**	−0.13	−0.31	−0.16	**−0.38***
Elev. IQ	**−0.47***	−0.07	−0.20	−0.19	−0.33
All returns above mean	−0.20	**0.51***	−0.03	**−0.41***	−0.01
First returns above mean	−0.20	**0.51***	−0.03	**−0.41***	−0.01

Values shown include the correlation coefficient, followed by the P category. ***, **, and * denote significance at p = 0.001, 0.01, and 0.05, respectively. Values shown in bold represent the LiDAR variable that had the highest correlation coefficient with the associated stand metric

Table S3. The C stock values obtained from LiDAR models of *Pinus halepensis* plantations at Los Cuadros (Murcia, Spain, see Fig. S1). Variables and abbreviations: biomass (W_t-S), soil organic carbon stock (0–10 cm soil layer) (SOC-S_{10}), soil organic carbon stock (0–40 cm soil layer) (SOC-S_{40}), biomass and soil organic carbon stock (0–10 cm soil layer) (W_t-S, SOC-S_{10}), and biomass and soil organic carbon stock (0–40 cm soil layer) (W_t-S, SOC-S_{40}). All values are expressed in Mg ha^{-1}.

	Min	Max	Mean	SD
Wt	6.38	48.10	22.73	8.71
SOC-S_{10}	4.46	47.78	20.99	10.22
SOC-S_{40}	30.81	124.02	66,24	22.79
W_t-S, SOC-S_{10}	27.14	77.34	41.36	10.82
W_t-S, SOC-S_{40}	57.94	153.58	89.42	21.59