Supplemantary material

Table S1. Description of tree vitalities according to Spanish National Forest Inventories codes.

q **value**	**Description**
1	Healthy, vigorous tree, optimally shaped, without signs of aging, capable of providing many valuable products. Not dominated/ overshadowed and with excellent future prospects.
2	Healthy, vigorous tree, not dominated, without signs of aging, with some shape defects, but capable of providing many valuable products.
3	Tree that is not entirely healthy and vigorous, or somewhat old or dominated, with many shape defects, but capable of providing some valuable products.
4	Sick and weak or old tree, with many shape defects, only capable of providing secondary value products.
5	Very sick, weak or old tree, with poor conformation and limited use and little value
6	Dead tree but not yet rotten and still capable of providing some usable good.

q: vitality of tree

Table S2. Comparison of goodness-of-fit between basic and final diameter tree growth models.

Tree species	Basic			Final		
	R^2m	R^2c	AIC	R^2m	R^2c	AIC
Pinus sylvestris	0.0063	0.6891	156600	0.1992	0.6911	154011
Pinus uncinata	0.0075	0.5788	13589	0.2424	0.6016	13189
Pinus pinea	0.0089	0.7662	31332	0.1842	0.7629	31029
Pinus halepensis	0.0141	0.7233	129190	0.1087	0.7298	127754
Pinus nigra	0.0203	0.7193	115082	0.1284	0.7098	113710
Pinus pinaster	0.0053	0.8207	107412	0.3251	0.8066	105188
Pinus canariensis	0.0104	0.6553	61253	0.0779	0.6574	60981
Pinus radiata	0.0875	0.8207	33053	0.3234	0.7300	32590
Abies alba	0.0462	0.5004	9278	0.1802	0.5014	9193
Quercus robur	0.0204	0.4608	32736	0.1016	0.4542	32356
Quercus petraea	0.0669	0.4719	17078	0.1279	0.4635	16989
Quercus pyrenaica	0.0550	0.5823	63504	0.1152	0.5718	62810
Quercus faginea	0.0447	0.4800	35035	0.0837	0.4721	34754
Quercus ilex	0.0249	0.4843	136059	0.0689	0.4928	135251
Quercus suber	0.0002	0.5067	37085	0.0423	0.5090	37007
Populus spp.	0.0158	0.6797	9359	0.2370	0.6976	9230
Eucalytus globulus	0.1554	0.8034	37763	0.3185	0.7735	37252
Eucalytus camaldulensis	0.1886	0.6904	3597	0.1614	0.7035	3529
Fagus sylvatica	0.0639	0.4620	129464	0.0717	0.4440	129028
Castanea sativa	0.0181	0.3629	23915	0.0595	0.3741	23833
Quercus pubescens	0.0513	0.4801	14321	0.0914	0.4803	14222
Betula spp.	0.0049	0.3989	14894	0.0785	0.3945	14773
Coniferous	0.0256	0.6333	56823	0.0324	0.6261	56577
Broadleaves	0.0360	0.5622	157823	0.0588	0.5628	157165

R^2m and R^2c are the marginal and conditional r-squared; AIC is the Akaike Information Criterion. Basic model represents Eq.1 with *x* as diameter and without including tree vitality, stand and site characteristics.

Table S3. Comparison of goodness-of-fit between basic and final height tree growth models.

Tree species	Basic			Final		
	R^2m	R^2c	AIC	R^2m	R^2c	AIC
P. sylvestris	0.111	0.617	-75457	0.165	0.632	-76743
P. uncinata	0.086	0.545	-8687	0.148	0.561	-8915
P. pinea	0.055	0.695	-19411	0.153	0.711	-19680
P. halepensis	0.035	0.596	-72400	0.099	0.611	-73391
P. nigra	0.057	0.665	-73973	0.126	0.688	-74959
P. pinaster	0.029	0.738	-34834	0.287	0.702	-37139
P. canariensis	0.043	0.512	-12911	0.154	0.584	-13589
P. radiata	0.067	0.484	6661	0.195	0.516	6366
A. alba	0.073	0.448	-1645	0.169	0.503	-1751
Q. robur	0.057	0.375	-1189	0.111	0.412	-1374
Q. petraea	0.005	0.465	-3573	0.053	0.499	-3655
Q. pyrenaica	0.016	0.463	-19810	0.070	0.522	-20284
Q. faginea	0.074	0.424	-17942	0.088	0.445	-18015
Q. ilex	0.026	0.401	-106231	0.058	0.436	-106871
Q. suber	0.096	0.476	-16205	0.145	0.512	-16473
Populus spp.	0.052	0.643	61	0.183	0.628	-34
E. globulus	0.012	0.540	6081	0.362	0.721	4579
E. camaldulensis	0.001	0.555	-177	0.160	0.731	-285
F. sylvatica	0.053	0.413	-9107	0.124	0.483	-10132
C. sativa	0.061	0.535	-1364	0.102	0.537	-1497
Q. pubescens	0.027	0.360	-6434	0.070	0.394	-6517
Betula spp.	0.044	0.450	-1557	0.077	0.464	-1599
Coniferous	0.030	0.662	-21531	0.039	0.670	-21610
Broadleaves	0.015	0.441	-7021	0.038	0.460	-7446

R^2m and R^2c are the marginal and conditional r-squared; AIC is the Akaike Information Criterion. Basic model represents Eq.1 with *x* as height and without including tree vitality, stand and site characteristics.

Table S4. Errors according to Eq.2 to 4 for diameter, height and volume, without considering random effects.

Tree species	*d*			*h*			v_{est}			v_{est_iv}			*RMSPE dif*
	MPE	MAPE	RMSPE	MPE	MAPE	RMSPE	MPE	MAPE	RMSPE	MPE	MAPE	RMSPE	
P. sylvestris	-0.37	6.82	9.28	0.03	10.20	14.04	0.40	20.11	27.09	-5.32	20.80	30.20	-10.3
P. uncinata	0.68	5.47	7.80	0.16	9.21	14.41	3.14	15.21	22.27	-0.22	16.19	24.24	-8.1
P. pinea	-1.40	6.32	8.74	-0.68	8.85	11.54	-2.48	18.05	26.06	-4.83	18.84	27.02	-3.5
P. halepensis	-1.43	7.82	10.23	-0.71	9.76	13.02	-0.28	19.59	26.98	-5.13	22.40	30.67	-12.1
P. nigra	-0.45	6.32	8.67	1.13	10.13	13.35	0.49	19.30	26.68	-6.00	19.79	29.31	-9.0
P. pinaster	-0.77	7.36	10.06	-0.54	9.97	13.38	-1.38	20.32	28.30	-4.43	20.93	30.45	-7.1
P. canariensis	-0.65	6.90	9.72	-4.80	12.72	18.44	-7.99	22.81	36.11	-6.74	25.13	50.61	-28.7
P. radiata	-2.49	6.85	8.94	-0.47	9.98	14.47	-4.97	17.03	23.34	-3.27	16.38	24.55	-4.9
A. alba	-1.85	6.94	9.14	-2.84	12.71	23.85	-8.51	25.79	44.17	-17.32	31.28	49.56	-10.9
Q. robur	-0.32	5.47	7.51	0.72	11.23	17.74	0.60	16.48	23.29	-9.43	22.16	33.74	-31.0
Q. petraea	-0.94	6.26	10.25	-1.05	12.92	22.00	-5.12	22.33	88.95	-9.60	25.57	89.15	-0.2
Q. pyrenaica	-0.33	5.26	7.25	1.31	10.16	14.02	-1.65	17.43	26.53	-6.45	19.73	28.86	-8.1
Q. faginea	0.00	5.44	7.46	0.95	9.79	13.90	-1.78	14.00	23.02	-6.75	15.51	24.68	-6.7
Q. ilex	-3.25	7.19	9.55	-2.79	10.44	13.92	-6.64	17.05	30.55	-8.62	17.86	33.46	-8.7
Q. suber	-1.05	15.39	18.76	-2.03	18.55	25.48	-18.40	48.59	68.90	-34.53	63.85	97.34	-29.2
Populus spp.	2.30	13.39	17.51	-57.46	57.51	72.85	-43.90	58.33	100.28	-47.60	70.20	145.32	-31.0
E. globulus	-1.85	11.79	14.65	-2.64	10.44	13.27	-10.16	29.40	36.83	-21.11	36.09	45.00	-18.2
E. camaldulensis	-1.61	5.42	7.41	-1.71	10.38	14.86	-3.91	17.16	27.93	-6.12	19.42	31.58	-11.6

F. sylvatica	-0.12	7.08	12.24	-0.87	15.13	26.64	-2.50	22.14	31.92	-8.83	24.43	34.96	-8.7
C. sativa	1.42	5.72	7.79	1.78	10.84	19.76	3.86	14.01	19.33	-5.76	16.87	22.57	-14.4
Q. pubescens	-3.17	9.37	11.77	-1.26	11.47	17.57	-8.50	24.69	32.73	-4.08	22.43	29.60	10.6
Betula spp.	0.29	7.32	10.43	4.68	11.05	15.07	3.19	16.64	23.65	-3.89	16.77	25.90	-8.7
Coniferous	-0.56	9.87	26.30	-0.49	14.64	26.38	-23.66	45.33	1116.54	-37.83	52.92	1107.13	0.9

Where MPE is the mean percentage error; MAPE is the mean absolute percentage error; RMSPE, is the root mean square percentage error, and RMSPE dif. is the difference between RMSPE, calculated as $100 \cdot (RMSPE_{vest} - RMSPE_{est\_iv}) / RMSPE_{est\_iv}$, all in %; and d, h, v_{est} and v_{est_iv} indicate the variables to which these errors refer: diameter, height, volume estimated using the methodology proposed in this study without considering random effects, and volume estimated using the iv equations from the SNFI.