Supplementary Material

Tab. S1 - Height and diameter of beech saplings (a) (N = 69) and trees (b) (N = 161) inventoried in 5 stands (DRC = diameter at root collar, DBH = diameter at breast or 1.3 m height). Out of these 69 saplings 20 were harvested. 66 trees were harvested from 161 trees. Details of those harvested plants are given in Tab. S2 and Tab. S3.

(a) Stand	*N*	Mean DRC (cm)	Minimum DRC (cm)	Maximum DRC (cm)	Mean Height (m)	Minimum Height (m)	Maximum Height (m)
Innerberg	17	2	1.1	4	1.8	0.5	3.5
Schönberg	6	3.1	1.6	4.1	2	1.3	3
Kätzler	7	1.6	1.1	2	1.8	1	2.5
Steinbruch	30	1.7	1.1	3.7	1.2	0.5	2.8
Steinmüri	9	2.7	1.1	3.5	0.9	0.5	1.3

(b) Stand	*N*	Mean DBH (cm)	Minimum DBH (cm)	Maximum DBH (cm)	Mean Height (m)	Minimum Height (m)	Maximum Height (m)
Innerberg	37	7.9	2.6	18	8.1	1.4	15
Schönberg	60	6.5	2	12.6	6.6	2.8	9.5
Kätzler	21	7.7	3.5	16	7	2.8	13
Steinbruch	14	8.2	2.1	13	6.4	2.2	14
Steinmüri	29	7.5	2.5	17	6.4	1.5	15

Tab. S2 - Primary data of the beech saplings ($N = 20$) (i.e. DRC category) which were used for parameterization of allometric equations. The given values represent both fresh and oven dried (105°C) weight for the trunk components like stem (ST), branch (BR) and total above ground biomass (AB). All measured values are in kilogram (kg) for mass, centimeter (cm) for DRC and meter (m) for height.

Locality	Plant id	DRC (cm)	Height (m)	ST (kg)_fresh	BR (kg)_fresh	AB (kg)_fresh	ST (kg)_dry	BR (kg)_dry	AB (kg)_dry	Height/DRC*100
Innerberg	IN_7	1.80	1.75	0.14	0.07	0.21	0.07	0.02	0.10	97.22
	IN_8	1.20	1.55	0.07	0.06	0.13	0.05	0.02	0.08	129.17
	IN_24	3.20	3.10	0.43	0.47	0.90	0.17	0.22	0.39	96.88
	IN_47	3.50	2.83	0.82	1.51	2.33	0.47	0.77	1.24	80.86
	IN_50	2.80	3.20	0.64	0.54	1.18	0.32	0.20	0.53	114.29
Schönberg	SÖ_33	1.60	1.40	0.10	0.14	0.24	0.07	0.07	0.13	87.50
	SÖ_55	2.60	1.92	0.37	0.28	0.66	0.27	0.18	0.45	73.85
Kätzler	KÄT_10	1.10	1.00	0.03	0.07	0.10	0.02	0.03	0.05	90.91
	KÄT_15	2.00	2.56	0.32	0.40	0.72	0.22	0.20	0.42	128.00
	KÄT_18	1.50	2.38	0.18	0.20	0.38	0.12	0.10	0.22	158.67
Steimüri	SMÜ_15	2.10	1.40	0.13	0.45	0.58	0.08	0.26	0.34	66.67
	SMÜ_16	1.10	0.44	0.02	0.09	0.11	0.01	0.03	0.04	40.00
	SMÜ_36	3.50	2.52	0.30	1.80	2.10	0.18	0.95	1.13	72.00
Steinbruch	SBR_8	3.70	2.46	0.43	0.77	1.20	0.26	0.49	0.75	66.49
	SBR_20	1.80	1.40	0.12	0.15	0.27	0.07	0.09	0.16	77.78
	SBR_21	2.30	1.65	0.08	0.15	0.23	0.05	0.08	0.13	71.74
	SBR_30	1.30	1.17	0.06	0.11	0.17	0.04	0.07	0.11	90.00
	SBR_37	1.10	0.64	0.02	0.03	0.04	0.01	0.02	0.03	58.18
	SBR_38	1.50	1.64	0.06	0.16	0.22	0.04	0.09	0.12	109.33
	SBR_41	2.00	1.60	0.08	0.15	0.23	0.05	0.08	0.13	80.00

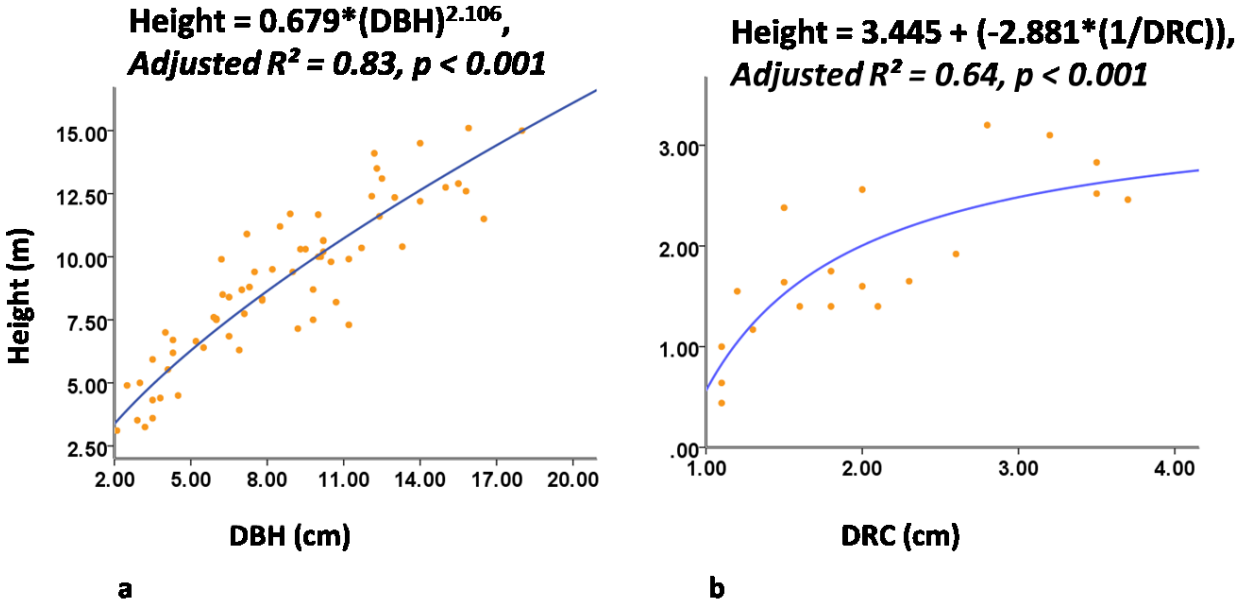
Tab. S3 - The harvested samples of beech trees ($N = 66$) for (i.e. DBH category) and primary data used for parameterization of allometric equations. The given values represent both fresh and oven dried (105°C) weight for trunk components like stem (ST), branch (BR) and total above ground biomass (AB). All measured values are in kilogram (kg) for mass, centimeter (cm) for DBH and meter (m) for height.

Locality	Plant id	DBH (cm)	H (m)	ST (kg)_fresh	BR (kg)_fresh	AB (kg)_fresh	ST (kg)_dry	BR (kg)_dry	AB (kg)_dry	Height/DBH*100
Innerberg	IN_1	9.0	9.4	25.16	17.10	42.26	14.53	9.64	24.17	104.44
	IN_2	9.5	10.3	27.84	12.30	40.14	16.45	6.22	22.67	108.42
	IN_9	14.0	12.2	76.00	32.00	108.00	48.27	17.59	65.86	87.14
	IN_12	15.9	15.1	103.31	19.20	122.51	64.24	10.67	74.91	94.97
	IN_13	12.4	11.6	53.91	16.40	70.31	33.81	5.86	39.66	93.55
	IN_17	12.1	12.4	64.82	21.86	86.68	39.81	11.56	51.38	102.48
	IN_21	15.8	12.6	97.02	40.97	137.99	59.29	22.51	81.80	79.75
	IN_28	4.1	5.5	3.87	2.30	6.17	2.35	1.12	3.47	134.88
	IN_37	6.5	8.4	12.19	8.87	21.06	7.44	4.49	11.94	129.23
	IN_40	8.5	11.2	27.73	7.62	35.35	17.01	3.94	20.95	131.76
	IN_43	6.0	7.5	7.69	6.79	14.48	4.80	3.74	8.53	125.67
	IN_45	3.5	5.9	2.94	0.84	3.78	1.88	0.54	2.42	169.43
	IN_46	5.5	6.4	7.99	3.93	11.92	4.73	1.98	6.71	116.36
	IN_49	13.3	10.4	48.94	11.90	60.84	24.23	5.99	30.22	78.20
	IN_51	10.0	10.0	28.74	6.75	35.49	17.81	3.44	21.25	100.00
	IN_54	18.0	15.0	156.39	53.79	210.18	94.97	31.61	126.58	83.33
	IN_55	6.0	7.5	9.85	4.61	14.46	5.99	2.14	8.13	125.00
	IN_56	8.2	9.5	22.94	10.80	33.74	13.50	5.02	18.52	115.85
	IN_57	10.2	10.7	32.24	9.87	42.11	19.94	5.48	25.41	104.41
Schönberg	SÖ_2	2.9	3.5	0.93	0.55	1.48	0.58	0.26	0.84	121.38
	SÖ_5	3.2	3.3	2.51	3.47	5.98	1.53	1.86	3.40	101.56
	SÖ_9	5.9	7.6	10.79	6.25	17.04	6.58	3.56	10.14	128.81
	SÖ_15	6.9	6.3	13.09	5.45	18.54	8.65	3.14	11.79	91.30
	SÖ_16	10.7	8.2	30.62	16.35	46.97	19.95	8.03	27.98	76.64
	SÖ_20	10.1	10.0	43.54	16.39	59.93	29.80	8.68	38.49	99.01

Locality	Plant id	DBH (cm)	H (m)	ST (kg)_fresh	BR (kg)_fresh	AB (kg)_fresh	ST (kg)_dry	BR (kg)_dry	AB (kg)_dry	Height/DBH*100
	SÖ_23	4.3	6.7	5.09	3.15	8.24	3.23	1.62	4.85	155.81
	SÖ_29	9.8	8.7	29.97	17.25	47.22	19.46	8.69	28.15	88.78
	SÖ_37	7.8	8.3	16.38	6.01	22.39	10.80	3.32	14.13	106.03
	SÖ_39	9.3	10.3	36.27	14.63	50.90	23.70	7.54	31.25	110.75
	SÖ_41	3.5	4.3	1.69	0.52	2.21	1.07	0.29	1.36	123.43
	SÖ_44	7.3	8.8	21.68	8.54	30.22	13.82	4.37	18.19	120.55
	SÖ_47	10.2	10.6	42.31	12.66	54.97	26.53	6.89	33.43	104.22
	SÖ_52	5.2	6.7	8.29	6.46	14.75	5.03	3.33	8.36	127.88
	SÖ_54	11.2	9.9	39.31	13.99	53.30	24.88	7.75	32.63	88.48
	SÖ_62	4.3	6.2	5.04	2.89	7.93	3.17	1.39	4.57	143.95
	SÖ_64	3.0	5.0	1.75	0.98	2.73	1.32	0.82	2.14	166.67
Kätzler	KÄT_2	14.0	14.5	101.12	47.51	148.63	59.58	25.75	85.33	103.57
	KÄT_3	7.8	8.3	19.78	11.82	31.60	12.53	5.97	18.50	106.79
	KÄT_4	8.9	11.7	31.32	11.09	42.41	19.91	5.47	25.38	131.46
	KÄT_8	10.0	11.7	44.23	23.59	67.82	26.67	12.33	39.00	116.70
	KÄT_13	6.5	6.9	10.59	9.22	19.81	6.52	4.61	11.12	105.38
	KÄT_21	7.1	7.7	14.05	10.78	24.83	8.46	5.50	13.96	109.01
	KÄT_22	2.5	4.9	1.55	0.98	2.53	0.95	0.50	1.45	196.00
	KÄT_27	12.2	14.1	72.56	13.47	86.03	45.79	7.47	53.26	115.57
	KÄT_28	12.5	13.1	67.95	33.58	101.53	41.60	18.25	59.85	104.80
Steimüri	SMÜ_2	7.5	9.4	26.89	13.56	40.45	16.54	6.23	22.77	125.33
	SMÜ_5	15.5	12.9	93.06	29.93	122.99	57.24	13.30	70.54	83.23
	SMÜ_6	16.5	11.5	89.06	21.03	110.09	58.18	11.75	69.94	69.70
	SMÜ_7	15.0	12.8	77.67	9.89	87.56	50.57	5.14	55.71	85.00
	SMÜ_9	10.2	10.2	34.62	11.28	45.90	22.19	5.79	27.99	100.00
	SMÜ_10	6.2	9.9	15.68	4.03	19.71	10.09	2.10	12.19	159.68
	SMÜ_11	7.2	10.9	26.28	10.22	36.50	16.35	5.00	21.35	151.39
	SMÜ_17	4.0	7.0	9.02	7.48	16.50	5.27	3.99	9.26	175.00
	SMÜ_18	3.8	4.4	2.72	2.27	4.99	1.67	1.11	2.79	115.79

Locality	Plant id	DBH (cm)	H (m)	ST (kg)_fresh	BR (kg)_fresh	AB (kg)_fresh	ST (kg)_dry	BR (kg)_dry	AB (kg)_dry	Height/DBH*100
	SMÜ_22	6.3	8.5	22.28	12.60	34.88	14.19	6.36	20.55	136.00
	SMÜ_24	10.5	9.8	37.48	13.01	50.49	24.52	6.74	31.27	93.33
	SMÜ_38	7.0	8.7	17.41	7.70	25.11	10.93	3.41	14.34	124.14
Steinbruch	SBR_2	9.2	7.2	23.78	13.80	37.58	14.91	7.00	21.92	77.72
	SBR_17	2.1	3.1	1.49	2.19	3.68	0.90	1.05	1.95	148.10
	SBR_31	4.5	4.5	5.29	4.49	9.78	3.33	2.27	5.60	100.00
	SBR_33	3.5	3.6	2.59	3.25	5.84	1.59	1.53	3.13	102.86
	SBR_35	11.7	10.4	54.67	29.04	83.71	35.74	15.94	51.68	88.46
	SBR_36	13.0	12.4	74.67	17.97	92.64	93.34	9.86	103.20	95.00
	SBR_39	12.3	13.5	77.56	25.08	102.64	49.27	13.47	62.74	109.76
	SBR_43	11.2	7.3	28.48	32.23	60.71	17.89	16.92	34.82	65.18
	SBR_44	9.8	7.5	28.88	20.59	49.47	18.16	10.85	29.01	76.53

Fig. S1 - Relationship between diameter and height for the sampled trees; a: trees in DBH category, b: saplings in DRC category.



Tab. S4 - Test of significance between observed and modelled values calculated from DRC based allometric equations with power functions. AB_fresh: total above ground fresh biomass, AB_dry: total above ground dry biomass, ST_fresh: fresh stem biomass with bark, ST_dry: stem with bark dry biomass, BR_fresh: fresh branch biomass with foliage, BR_dry: dry branch biomass with foliage.

Equation type	Significance testing for biomass model by Wilcoxon signed-rank test
AB_fresh	$Z = -0.411$, $N = 20$; $p > 0.05$
AB_dry	$Z = -0.709$, $N = 20$; $p > 0.05$
ST_fresh	$Z = -0.373$, $N = 20$; $p > 0.05$
ST_dry	$Z = -0.299$, $N = 20$; $p > 0.05$
BR_fresh	$Z = -0.299$, $N = 20$; $p > 0.05$
BR_dry	$Z = 0.000$, $N = 20$; $p > 0.05$

Tab. S5 - Significance testing for biomass models between observed and modelled biomass calculated from DBH based allometric equations with power functions. AB_fresh: total above ground fresh biomass, AB_dry: total above ground dry biomass, ST_fresh: fresh stem biomass with bark, ST_dry: dry stem biomass with bark, BR_fresh: fresh branch biomass with foliage, BR_dry: dry branch biomass with foliage.

Equation type	Equation number	Significance testing for biomass model by Wilcoxon signed-rank test
AB_fresh	7	$Z = -0.514$, $N = 66$; $p > 0.05$
AB_dry	8	$Z = -0.003$, $N = 66$; $p > 0.05$
ST_fresh	9	$Z = -0.061$, $N = 66$; $p > 0.05$
ST_dry	10	$Z = -0.316$, $N = 66$; $p > 0.05$
BR_fresh	11	$Z = -1.198$, $N = 66$; $p > 0.05$
BR_dry	12	$Z = -0.886$, $N = 66$; $p > 0.05$

Tab. S6 - Correlation results between modelled weights of fresh and dry biomass in DRC and DBH categories. AB_dry: total above ground dry biomass, ST_dry: dry stem biomass with bark, BR_dry: dry branch biomass with foliage, AB_fresh: total above ground fresh biomass, ST_fresh: fresh stem biomass with bark, BR_fresh: fresh branch biomass with foliage.

Biomass models	Correlation results of the models
AB_fresh - AB_dry (DRC)	Spearman's rho = 1.000, $N = 20$, $p < 0.001$
AB_fresh - AB_dry (DBH)	Spearman's rho = 1.000, $N = 66$, $p < 0.001$
ST_fresh - ST_dry (DRC)	Spearman's rho = 1.000, $N = 20$, $p < 0.001$
ST_fresh - ST_dry (DBH)	Spearman's rho = 1.000, $N = 66$, $p < 0.001$
BR_fresh - BR_dry (DRC)	Spearman's rho = 1.000, $N = 20$, $p < 0.001$
BR_fresh - BR_dry (DBH)	Spearman's rho = 1.000, $N = 66$, $p < 0.001$

Tab. S7 - Comparisons between observed values in dry biomass and modelled values from solely diameter based plus diameter and height based equations developed by linear regressions in DBH and DRC categories. Biomass, height and diameter values were log transformed in the models.

Equation type	Comparing to	Significance testing for biomass model by Wilcoxon signed-rank test or paired sampled *t* test
AB_dry	Modelled biomass_DBH	Z = -0.048, $N = 66$; $p > 0.05$
	Modelled biomass_DBH and height	Z = -0.029, $N = 66$; $p > 0.05$
	Modelled biomass_DRC	t(-0.02), *d.f. =19; p > 0.05*
	Modelled biomass_DRC and height	t(-0.07), *d.f. =19; p > 0.05*
ST_dry	Modelled biomass_DBH	Z = -0.495, $N = 66$; $p > 0.05$
	Modelled biomass_DBH and height	Z = -1.964, $N = 66$; $p < 0.05$
	Modelled biomass_DRC	t(-0.02), *d.f. =19; p > 0.05*
	Modelled biomass_DRC and height	t(-0.00), *d.f. =19; p > 0.05*
BR_dry	Modelled biomass_DBH	Z = -0.412, $N = 66$; $p > 0.05$
	Modelled biomass_DBH and height	Z = -0.386, $N = 66$; $p > 0.05$
	Modelled biomass_DRC	t(-0.02), *d.f. =19; p > 0.05*
	Modelled biomass_DRC and height	t(-0.01), *d.f. =19; p > 0.05*

Tab. S8 - Significance testing between modelled biomass of this study and different biomass predicted by power function models from literature in plants of DBH category. AB_dry: total above ground dry biomass, ST_dry: dry stem biomass with bark, BR_dry: dry branch biomass with foliage.

Equation type	Comparing to	Significance testing for biomass model by Wilcoxon signed-rank test
AB_dry	Cienciala et al. (2005)	$Z = -7.062$, $N = 66$; $p < 0.001$
	Pretzsch (2000)	$Z = -5.817$, $N = 66$; $p < 0.001$
	Bartelink (1997)	$Z = -2.316$, $N = 66$; $p < 0.05$
	Santa Regina et al. (1997)	$Z = -6.238$, $N = 66$; $p < 0.001$
	Stankic et al. (2014)	$Z = -6.328$, $N = 66$; $p < 0.001$
ST_dry	Cienciala et al. (2005)	$Z = -7.062$, $N = 66$; $p < 0.001$
	Bartelink 1997	$Z = -6.398$, $N = 66$; $p < 0.001$
	Santa Regina et al. (1997)	$Z = -7.056$, $N = 66$; $p < 0.001$
BR_dry	Bartelink 1997	$Z = -5.440$, $N = 66$; $p < 0.001$