

Kangas A., Henttonen H.M., Pitkänen T.P., Sarkkola S., Heikkinen J. (2020). Re-calibrating stem volume models – is there change in the tree trunk form from the 1970s to the 2010s in Finland? *Silva Fennica* vol. 54 no. 4 article 10269. <https://doi.org/10.14214/sf.10269>

## Supplementary file S3

Models 5-8 as mixed models with plot effect.

### Model 5

#### Pine

	Value	Std.Error	DF	t-value	p-value
Intercept	-2.0367930	0.02314370	2033	-88.0064	0
log(dbh)	2.4724878	0.00755509	2033	327.2611	0
$\lambda$	0.5228558	0.05063356	935	10.3263	0
log(dbh)* $\lambda$	-0.1447463	0.01621550	2033	-8.9264	0

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	6	-2929.424	-2893.450	1470.712			
2	4	-2832.404	-2808.419	1420.202	1 vs 2	101.0202	<.0001

#### Spruce

	Value	Std.Error	DF	t-value	p-value
Intercept	-2.3582611	0.02320623	1656	-101.6219	0.0000
log(dbh)	2.5911247	0.00812558	1656	318.8850	0.0000
$\lambda$	0.1976194	0.06013133	801	3.2865	0.0011
log(dbh)* $\lambda$	-0.0423387	0.01974860	1656	-2.1439	0.0322

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	6	-1683.553	-1648.713	847.7765			
2	4	-1675.206	-1651.976	841.6028	1 vs 2	12.3474	0.0021

#### Birch

	Value	Std.Error	DF	t-value	p-value
Intercept	-2.0293960	0.03523942	626	-57.58881	0.0000
log(dbh)	2.5092641	0.01275148	626	196.78224	0.0000
$\lambda$	0.1983989	0.07350486	555	2.69913	0.0072
log(dbh)* $\lambda$	-0.0573609	0.02650790	626	-2.16392	0.0308

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	6	-632.0462	-601.6015	322.0231			
2	4	-637.3063	-617.0031	322.6532	1 vs 2	1.260167	0.5325

**Model 6**

Pine

	Value	Std.Error	DF	t-value	p-value
Intercept	-5.067374	0.05749769	2031	-88.13178	0.0000
$\log(2 + 1.25 * dbh)$	3.369382	0.02572838	2031	130.95973	0.0000
dbh	-0.031586	0.00135951	2031	-23.23321	0.0000
$\lambda$	0.826011	0.13570908	935	6.08663	0.0000
$\log(2 + 1.25 * dbh) * \lambda$	-0.254789	0.05851501	2031	-4.35424	0.0000
dbh* $\lambda$	0.004559	0.00287774	2031	1.58411	0.1133

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	8	-3036.664	-2988.704	1526.332			
2	5	-2944.286	-2914.307	1477.143	1 vs 2	98.3776	<.0001

Spruce

	Value	Std.Error	DF	t-value	p-value
Intercept	-5.400010	0.05741218	1654	-94.05687	0.0000
$\log(2 + 1.25 * dbh)$	3.468740	0.02650525	1654	130.86993	0.0000
dbh	-0.030014	0.00149306	1654	-20.10215	0.0000
$\lambda$	-0.398801	0.17505971	801	-2.27809	0.0230
$\log(2 + 1.25 * dbh) * \lambda$	0.215842	0.07363063	1654	2.93142	0.0034
dbh* $\lambda$	-0.011058	0.00333580	1654	-3.31492	0.0009

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	8	-2033.893	-1987.446	1024.947			
2	5	-2028.861	-1999.825	1019.431	1 vs 2	11.0323	0.0116

Birch

	Value	Std.Error	DF	t-value	p-value
Intercept	-5.433220	0.09886593	624	-54.95543	0.0000
$\log(2 + 1.25 * dbh)$	3.590881	0.04733183	624	75.86608	0.0000
dbh	-0.043812	0.00285920	624	-15.32309	0.0000
$\lambda$	0.751047	0.21702848	555	3.46059	0.0006
$\log(2 + 1.25 * dbh) * \lambda$	-0.297834	0.10202519	624	-2.91922	0.0036
dbh* $\lambda$	0.012188	0.00590258	624	2.06489	0.0393

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	8	-728.1376	-687.5582	372.0688			
2	5	-730.3487	-704.9738	370.1743	1 vs 2	3.788933	0.2852

**Model 7**

Pine

	Value	Std.Error	DF	t-value	p-value
Intercept	-3.387721	0.0432474	2027	-78.33347	0.0000
log(dbh)	2.005403	0.0146985	2027	136.43571	0.0000
log(h)	2.158674	0.0574153	2027	37.59753	0.0000
log(h - 1.3)	-1.122592	0.0496793	2027	-22.59675	0.0000
dbh	-0.004171	0.0006874	2027	-6.06749	0.0000
$\lambda$	0.594912	0.1596207	935	3.72703	0.0002
log(dbh)* $\lambda$	-0.177789	0.0312015	2027	-5.69810	0.0000
log(h)* $\lambda$	-1.133863	0.3349777	2027	-3.38489	0.0007
log(h - 1.3)* $\lambda$	1.119285	0.3010738	2027	3.71764	0.0002
dbh* $\lambda$	0.003167	0.0014807	2027	2.13902	0.0326

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	12	-8023.882	-7951.958	4023.941			
2	7	-7951.228	-7909.260	3982.614	1 vs 2	82.65408	<.0001

Spruce

	Value	Std.Error	DF	t-value	p-value
Intercept	-3.716753	0.0417289	1650	-89.06907	0.0000
log(dbh)	1.902683	0.0175037	1650	108.70198	0.0000
log(h)	2.754082	0.0483855	1650	56.91959	0.0000
log(h - 1.3)	-1.478680	0.0410599	1650	-36.01277	0.0000
dbh	-0.007685	0.0008134	1650	-9.44800	0.0000
$\lambda$	0.019265	0.1690742	801	0.11395	0.9093
log(dbh)* $\lambda$	-0.025747	0.0422687	1650	-0.60914	0.5425
log(h)* $\lambda$	0.061191	0.3486874	1650	0.17549	0.8607
log(h - 1.3)* $\lambda$	-0.043701	0.3130753	1650	-0.13959	0.8890
dbh* $\lambda$	-0.000504	0.0017719	1650	-0.28472	0.7759

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	12	-6186.791	-6117.140	3105.396			
2	7	-6211.768	-6171.124	3112.884	1 vs 2	14.97662	0.0105

Birch

	Value	Std.Error	DF	t-value	p-value
Intercept	-4.578162	0.0904193	620	-50.63258	0.0000
log(dbh)	2.112897	0.0261906	620	80.67381	0.0000
log(h)	4.113211	0.1551789	620	26.50625	0.0000
log(h - 1.3)	-2.764792	0.1380072	620	-20.03367	0.0000
dbh	-0.015000	0.0014831	620	-10.11389	0.0000
$\lambda$	0.459997	0.2388400	555	1.92596	0.0546
log(dbh)* $\lambda$	-0.219793	0.0493465	620	-4.45408	0.0000
log(h)* $\lambda$	-0.407855	0.5332460	620	-0.76485	0.4446
log(h - 1.3)* $\lambda$	0.385002	0.4769853	620	0.80716	0.4199
dbh* $\lambda$	0.012263	0.0028760	620	4.26396	0.0000

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	12	-2576.311	-2515.483	1300.156			
2	7	-2570.226	-2534.713	1292.113	1 vs 2	16.08546	0.0066

**Model 8**

Pine

	Value	Std.Error	DF	t-value	p-value
Intercept	-4.461758	0.02687536	2029	-166.01670	0.0000
$\log(2 + 1.25 * dbh)$	2.365242	0.01593512	2029	148.42956	0.0000
dbh	-0.011197	0.00063954	2029	-17.50774	0.0000
$\log(h)$	0.862837	0.00898337	2029	96.04832	0.0000
$\lambda$	-0.031545	0.06479634	935	-0.48683	0.6265
$\log(2 + 1.25 * dbh) * \lambda$	-0.109797	0.03302943	2029	-3.32422	0.0009
dbh * $\lambda$	-0.001249	0.00138942	2029	-0.89928	0.3686
$\log(h) * \lambda$	0.149441	0.01681042	2029	8.88976	0.0000

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	10	-7843.210	-7783.267	3931.605			
2	6	-7775.277	-7739.303	3893.638	1 vs 2	75.93281	<.0001

Spruce

	Value	Std.Error	DF	t-value	p-value
Intercept	-4.161195	0.03133581	1652	-132.79363	0.0000
$\log(2 + 1.25 * dbh)$	2.105735	0.02110758	1652	99.76201	0.0000
dbh	-0.005566	0.00077392	1652	-7.19149	0.0000
$\log(h)$	1.013423	0.01259709	1652	80.44895	0.0000
$\lambda$	-0.260313	0.09214958	801	-2.82490	0.0048
$\log(2 + 1.25 * dbh) * \lambda$	0.026453	0.05017486	1652	0.52723	0.5981
dbh * $\lambda$	-0.005975	0.00176585	1652	-3.38359	0.0007
$\log(h) * \lambda$	0.106626	0.02505397	1652	4.25586	0.0000

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	10	-5704.294	-5646.243	2862.147			
2	6	-5697.290	-5662.450	2854.645	1 vs 2	15.00381	0.0047

Birch

	Value	Std.Error	DF	t-value	p-value
Intercept	-5.130712	0.04390932	622	-116.84789	0.0000
$\log(2 + 1.25 * dbh)$	2.498956	0.02854293	622	87.55078	0.0000
dbh	-0.021161	0.00133666	622	-15.83100	0.0000
$\log(h)$	0.995161	0.01781880	622	55.84892	0.0000
$\lambda$	0.298589	0.10092814	555	2.95843	0.0032
$\log(2 + 1.25 * dbh) * \lambda$	-0.201969	0.05769903	622	-3.50038	0.0005
dbh * $\lambda$	0.009635	0.00283513	622	3.39845	0.0007
$\log(h) * \lambda$	0.046720	0.03212208	622	1.45444	0.1463

Model	df	AIC	BIC	logLik	Test	L.Ratio	p-value
1	10	-2506.575	-2455.867	1263.287			
2	6	-2515.043	-2484.599	1263.522	1 vs 2	0.4687819	0.9765