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Appendix 1

Table A1. Description of the six different forest types of the study, including their location, the whole range of canopy species with a diameter at height breast > 7.5 cm, species richness range and the number of plots selected in each forest type.

Forest type	Location	Coordinate	Canopy species (DBH ≥ 7.5 cm)	Dominant canopy trees (> 90% plot basal area)	Species richness range	No. of plots
Boreal	North Karelia region (Finland)	(62.6º N, 29.9º E)	*Alnus* sp., *Betula pendula, Betula pubescens, Picea abies, Pinus sylvestris, Populus tremula, Salix caprea, Sorbus aucuparia*	*Betula sp., Picea abies, Pinus sylvestris,*	1-7	28
Hemiboreal	Bialowieza Forest (Poland)	(52.7° N, 23.9º E)	*Acer pseudoplatanus, Acer platanoides, B. pendula, Carpinus betulus, Corylus avellana, Fagus sylvatica, Fraxinus excelsior, P. abies, P. sylvestris, P. tremula, Quercus robur, Sorbus aucuparia, Tilia cordata.*	*B. pendula, Carpinus betulus, P. abies, P. sylvestris, Quercus robur*	2-6	43
Sub-continental temperate	Carpathian Mountains (Romania)	(47.6º N, 25.3º E)	*Abies alba, A. pseudoplatanus, Alnus* sp., *Betula* sp., *C. betulus, F. sylvatica, F. excelsior, P. abies, P. tremula, Ulmus minor*	*Abies alba, A. pseudoplatanus, F. sylvatica, P. abies*	1-6	28
Temperate	Hainich National Park (Germany)	(51.5º N, 10.2º E)	*Acer campestre, Acer platanoides, A. pseudoplatanus, Alnus glutinosa, Alnus incana, B. pendula, C. betulus, Crataegus* sp., *F. sylvatica, F. excelsior, P. abies, P. sylvestris, Prunus avium, Q-. petraea, Q. robur, Quercus rubra, S. caprea, Sorbus torminalis, Tilia cordata, Tilia platyphyllos, Ulmus glabra*	*A. pseudoplatanus, F. sylvatica, F. excelsior, P. abies, Q. petraea*	1-7	38
Temperate Mediterranean	Southern Central Tuscany (Italy)	(43° N, 11° E)	*A. campestre, Acer monspessulanum, Arbutus unedo, C. betulus, Castanea sativa, Chamaecyparis lawsoniana, Corylus avellana, F. sylvatica, Fraxinus ornus, Ilex aquifolium, Ostrya carpinifolia, P. tremula, P. avium, Pseudotsuga menziesii, Quercus cerris, Quercus crenata, Quercus ilex, Q. petraea, Quercus pubescens, Sorbus domestica, S. torminalis, T. cordata*	*Castanea sativa, Ostrya carpinifolia, Quercus cerris, Quercus ilex, Q. petraea*	1-10	36
Continental Mediterranean	Alto Tajo Natural Park (Spain)	(40.7º N, -1.9º E)	*Buxus sempervirens, Crataegus* sp., *Juniperus communis, Juniperus oxycedrus, Juniperus phoenicia, Juniperus* sp., *Junipeus thurifera, Pinus nigra, P. sylvestris, Quercus faginea, Q. ilex, Viburnum* sp.	*Pinus nigra, P. sylvestris, Quercus faginea, Q. ilex*	1-7	36

Table A2. Number of trees (N_{ind}), number of species (S) in 30 × 30 m plots and number of trees per hectare (N_{ind}/ha) in each forest type.

Boreal				Hemiboreal				Sub-cont. Temperate				Temperate				Temp. Mediterranean				Cont. Mediterranean			
Plot	**N_{ind}**	**N_{ind}/ha**	**S**	**Plot**	**N_{ind}**	**N_{ind}/ha**	**S**	**Plot**	**N_{ind}**	**N_{ind}/ha**	**S**	**Plot**	**N_{ind}**	**N_{ind}/ha**	**S**	**Plot**	**N_{ind}**	**N_{ind}/ha**	**S**	**Plot**	**N_{ind}**	**N_{ind}/ha**	**S**
1	69	766.7	3	1	36	400.0	2	1	37	411.1	3	1	32	355.6	1	1	63	700.0	5	1	67	744.4	6
2	52	577.8	3	2	36	400.0	3	2	51	566.7	1	2	29	322.2	3	2	40	444.4	6	2	75	833.3	5
3	40	444.4	3	3	37	411.1	2	3	58	644.4	5	3	54	600.0	4	3	55	611.1	3	3	36	400.0	3
4	55	611.1	3	4	52	577.8	4	4	43	477.8	3	4	50	555.6	6	4	53	588.9	6	4	20	222.2	2
5	47	522.2	7	5	58	644.4	2	5	51	566.7	5	5	62	688.9	5	5	63	700.0	5	5	38	422.2	2
6	79	877.8	2	6	67	744.4	4	6	78	866.7	2	6	61	677.8	4	6	99	1100.0	3	6	36	400.0	2
7	61	677.8	5	7	37	411.1	4	7	65	722.2	5	7	88	977.8	5	7	47	522.2	2	7	33	366.7	7
8	48	533.3	4	8	39	433.3	2	8	34	377.8	4	8	97	1077.8	3	8	100	1111.1	6	8	67	744.4	2
9	61	677.8	5	9	28	311.1	3	9	44	488.9	6	9	164	1822.2	4	9	95	1055.6	10	9	101	1122.2	1
10	67	744.4	3	10	38	422.2	3	10	28	311.1	4	10	68	755.6	3	10	49	544.4	6	10	53	588.9	1
11	73	811.1	3	11	55	611.1	3	11	34	377.8	2	11	33	366.7	4	11	76	844.4	8	11	67	744.4	1
12	150	1666.7	4	12	27	300.0	2	12	31	344.4	1	12	23	255.6	4	12	75	833.3	4	12	71	788.9	2
13	90	1000.0	4	13	35	388.9	4	13	31	344.4	2	13	31	344.4	7	13	55	611.1	7	13	70	777.8	4
14	53	588.9	1	14	35	388.9	4	14	41	455.6	3	14	46	511.1	6	14	49	544.4	7	14	44	488.9	4
15	61	677.8	4	15	41	455.6	3	15	52	577.8	3	15	47	522.2	2	15	39	433.3	3	15	41	455.6	3
16	66	733.3	3	16	40	444.4	4	16	69	766.7	3	16	36	400.0	4	16	43	477.8	4	16	48	533.3	4
17	62	688.9	2	17	51	566.7	5	17	62	688.9	3	17	52	577.8	2	17	41	455.6	7	17	97	1077.8	4
18	86	955.6	2	18	66	733.3	4	18	46	511.1	3	18	57	633.3	5	18	61	677.8	6	18	58	644.4	1
19	58	644.4	3	19	48	533.3	4	19	31	344.4	4	19	26	288.9	4	19	34	377.8	4	19	63	700.0	2
20	65	722.2	3	20	60	666.7	4	20	52	577.8	6	20	62	688.9	5	20	83	922.2	7	20	69	766.7	1
21	50	555.6	2	21	76	844.4	6	21	70	777.8	3	21	20	222.2	5	21	32	355.6	2	21	67	744.4	2
22	103	1144.4	2	22	45	500.0	4	22	41	455.6	2	22	70	777.8	5	22	71	788.9	9	22	69	766.7	2
23	90	1000.0	2	23	45	500.0	4	23	61	677.8	2	23	50	555.6	6	23	51	566.7	8	23	54	600.0	4
24	171	1900.0	4	24	61	677.8	6	24	66	733.3	4	24	21	233.3	3	24	49	544.4	3	24	58	644.4	4
25	110	1222.2	4	25	56	622.2	5	25	49	544.4	4	25	40	444.4	4	25	50	555.6	4	25	52	577.8	4
26	73	811.1	5	26	62	688.9	5	26	38	422.2	4	26	44	488.9	6	26	74	822.2	5	26	47	522.2	4
27	87	966.7	4	27	36	400.0	4	27	35	388.9	5	27	27	300.0	4	27	77	855.6	5	27	68	755.6	4
28	65	722.2	4	28	54	600.0	4	28	59	655.6	4	28	31	344.4	4	28	45	500.0	5	28	110	1222.2	4
				29	48	533.3	6					29	41	455.6	5	29	48	533.3	5	29	103	1144.4	4
				30	59	655.6	5					30	32	355.6	3	30	39	433.3	7	30	49	544.4	4
				31	49	544.4	4					31	23	255.6	5	31	57	633.3	3	31	34	377.8	2
				32	75	833.3	6					32	50	555.6	4	32	48	533.3	8	32	26	288.9	3
				33	41	455.6	4					33	46	511.1	5	33	69	766.7	8	33	34	377.8	4
				34	50	555.6	5					34	68	755.6	5	34	91	1011.1	9	34	65	722.2	4
				35	42	466.7	5					35	29	322.2	5	35	74	822.2	1	35	60	666.7	5
				36	44	488.9	6					36	25	277.8	5	36	69	766.7	7	36	43	477.8	5
				37	44	488.9	6					37	29	322.2	5								
				38	63	700.0	5					38	26	288.9	6								
				39	51	566.7	5																
				40	51	566.7	3																
				41	62	688.9	6																
				42	39	433.3	5																
				43	39	433.3	4																

Table A3. Mean trait values used for calculating functional diversity indexes. Mean values obtained from global databases: TRY (Kattge et al. 2011), LEDA (Kleyer et al. 2008), KEW ("Royal Botanic Gardens Kew." 2019), BiolFlor (Kühn et al. 2004) and literature (e.g. shade tolerance trait values from Niinemets and Valladares (2006)). MH: maximum height (m). Sm: seed mass (g). SLA: specific leaf area ($mm^2\ mg^{-1}$). WD: wood density ($g\ cm^{-3}$). ST: shade tolerance ranging from 0 (no tolerance) to 5 (maximal tolerance).

Species	MH	SM	SLA	WD	ST	Forest type
Alnus_incana	11.80	0.00	17.34	0.55	2.30	Boreal
Betula_pendula	26.20	0.00	14.28	0.56	2.03	Boreal
Betula_pubescens	21.90	0.00	14.39	0.65	1.85	Boreal
Picea_abies	26.00	0.01	3.01	0.46	4.45	Boreal
Pinus_sylvestris	25.60	0.01	2.86	0.47	1.67	Boreal
Populus_tremula	18.80	0.00	15.33	0.45	2.22	Boreal
Salix_caprea	14.50	0.00	14.40	0.45	2.16	Boreal
Sorbus_aucuparia	8.90	0.00	13.90	0.70	2.73	Boreal
Acer_campestre	23.20	0.11	13.80	0.65	3.18	Temperate
Acer_platanoides	31.30	0.13	18.30	0.65	4.20	Temperate
Acer_pseudoplatanus	35.20	0.10	22.18	0.55	3.73	Temperate
Alnus_glutinosa	22.80	0.00	14.58	0.55	2.71	Temperate
Alnus_incana	10.50	0.00	20.11	0.55	2.30	Temperate
Betula_pendula	26.60	0.00	13.66	0.54	2.03	Temperate
Carpinus_betulus	33.00	0.05	25.90	0.75	3.97	Temperate
Crataegus_monogyna	6.90	0.10	11.70	0.57	1.93	Temperate
Fagus_sylvatica	39.10	0.25	26.68	0.60	4.56	Temperate
Fraxinus_excelsior	42.40	0.07	13.92	0.65	2.66	Temperate
Picea_abies	36.40	0.01	4.25	0.32	4.45	Temperate
Pinus_sylvestris	27.10	0.01	3.78	0.48	1.67	Temperate
Prunus_avium	16.10	0.19	10.10	0.55	3.33	Temperate
Quercus_petraea	37.80	0.99	13.63	0.59	2.73	Temperate
Quercus_robur	35.10	3.36	14.67	0.65	2.45	Temperate
Quercus_rubra	34.30	3.69	16.00	0.42	2.75	Temperate
Salix_caprea	17.70	0.00	14.40	0.45	2.16	Temperate
Sorbus_torminalis	21.30	0.03	35.73	0.75	3.38	Temperate
Tilia_cordata	27.40	0.04	27.17	0.45	4.18	Temperate
Tilia_platyphyllos	26.20	0.15	26.99	0.45	4.00	Temperate
Ulmus_glabra	27.40	0.01	28.13	0.65	3.53	Temperate
Acer_platanoides	27.90	0.13	18.30	0.65	4.20	Hemiboreal
Acer_pseudoplatanus	11.60	0.10	16.17	0.55	3.73	Hemiboreal
Betula_pendula	43.30	0.00	15.18	0.54	2.03	Hemiboreal
Carpinus_betulus	33.80	0.05	25.90	0.75	3.97	Hemiboreal
Corylus_avellana	17.30	0.81	22.66	0.49	3.53	Hemiboreal
Fagus_sylvatica	22.50	0.25	22.19	0.60	4.56	Hemiboreal
Fraxinus_excelsior	34.10	0.07	13.92	0.65	2.66	Hemiboreal
Picea_abies	40.20	0.01	4.25	0.32	4.45	Hemiboreal
Pinus_sylvestris	41.70	0.01	3.53	0.48	1.67	Hemiboreal
Populus_tremula	35.60	0.00	15.33	0.45	2.22	Hemiboreal
Quercus_robur	42.50	3.36	14.67	0.65	2.45	Hemiboreal
Sorbus_aucuparia	11.20	0.00	13.90	0.70	2.73	Hemiboreal
Tilia_platyphyllos	26.80	0.09	27.08	0.45	4.00	Hemiboreal
Abies_alba	43.60	0.07	4.78	0.45	4.60	Subcontinental temperate

Acer_pseudoplatanus	39.70	0.10	12.67	0.55	3.73	Subcontinental temperate
Alnus_glutinosa	22.90	0.00	17.34	0.55	2.30	Subcontinental temperate
Betula_pendula	18.20	0.00	14.34	0.53	2.03	Subcontinental temperate
Carpinus_betulus	20.70	0.05	25.90	0.75	3.97	Subcontinental temperate
Fagus_sylvatica	42.80	0.25	19.35	0.58	4.56	Subcontinental temperate
Fraxinus_excelsior	32.00	0.07	13.92	0.65	2.66	Subcontinental temperate
Picea_abies	45.50	0.01	4.35	0.36	4.45	Subcontinental temperate
Populus_tremula	27.70	0.00	15.33	0.45	2.22	Subcontinental temperate
Ulmus_minor	31.30	0.01	26.07	0.65	1.20	Subcontinental temperate
Buxus_sempervirens	3.20	0.01	7.03	0.21	4.05	Continental mediterranean
Crataegus_monogyna	3.90	0.10	11.70	0.46	1.93	Continental mediterranean
Juniperus_communis	4.50	0.03	6.28	0.65	1.71	Continental mediterranean
Juniperus_oxycedrus	5.50	0.29	5.84	0.55	1.67	Continental mediterranean
Juniperus_phoenicia	4.50	0.02	6.06	0.55	1.84	Continental mediterranean
Juniperus_thurifera	8.10	0.04	5.95	0.53	1.68	Continental mediterranean
Pinus_nigra	20.70	0.02	3.62	0.42	2.10	Continental mediterranean
Pinus_sylvestris	23.50	0.01	2.89	0.43	1.67	Continental mediterranean
Quercus_faginea	16.80	1.87	11.87	0.59	3.13	Continental mediterranean
Quercus_ilex	11.50	2.31	4.36	0.82	3.02	Continental mediterranean
Viburnum_opulus	5.70	0.03	16.75	0.40	2.66	Continental mediterranean
Acer_campestre	9.70	0.11	13.11	0.65	3.18	Mediterranean temperate
Acer_monspessulanum	11.90	0.12	12.24	0.61	2.66	Mediterranean temperate
Arbutus_unedo	14.90	0.00	8.19	0.29	2.66	Mediterranean temperate
Carpinus_betulus	20.10	0.05	27.42	0.75	3.97	Mediterranean temperate
Castanea_sativa	24.10	7.65	14.70	0.50	3.15	Mediterranean temperate
Chamaecyparis_lawsoniana	13.40	0.00	7.17	0.45	3.67	Mediterranean temperate
Corylus_avellana	16.60	0.81	32.13	0.49	3.53	Mediterranean temperate
Fagus_sylvatica	12.20	0.25	22.10	0.66	4.56	Mediterranean temperate
Fraxinus_ornus	25.30	0.04	17.50	0.20	3.02	Mediterranean temperate
Ilex_aquifolium	15.00	0.03	6.85	0.41	3.86	Mediterranean temperate
Ostrya_carpinifolia	27.50	0.01	25.50	0.77	3.94	Mediterranean temperate
Populus_tremula	21.70	0.00	15.33	0.45	2.22	Mediterranean temperate
Prunus_avium	10.60	0.19	10.10	0.55	3.33	Mediterranean temperate
Pseudotsuga_menziesii	17.80	0.02	7.16	0.43	2.78	Mediterranean temperate
Quercus_cerris	33.70	4.21	14.80	0.70	2.55	Mediterranean temperate
Quercus_crenata	15.20	4.21	10.00	0.70	2.55	Mediterranean temperate
Quercus_ilex	26.00	2.31	4.36	0.82	3.02	Mediterranean temperate
Quercus_petraea	29.30	0.99	13.42	0.66	2.73	Mediterranean temperate
Quercus_pubescens	10.90	0.63	14.48	0.64	2.31	Mediterranean temperate
Sorbus_domestica	17.10	0.03	9.90	0.84	3.53	Mediterranean temperate
Sorbus_torminalis	21.00	0.03	35.73	0.75	3.38	Mediterranean temperate
Tilia_cordata	10.10	0.04	27.17	0.45	4.18	Mediterranean temperate

Table A4. Summary table of the fitted generalized linear model assessing the effect of species richness, functional diversity and forest type on the mean number of intraspecific neighbors calculated for all species in all forests within a radius of 7.5 m. Data shown are the degrees of freedom (df), the LT test based on χ^2 statistic and the statistical significance level of model using type II ANOVA, the estimated coefficients for species richness (Coef.) and the coefficient of determination of the model R^2.

	df	Coef.	LR χ^2	p-value
Intercept	-	2.35	-	-
Species richness	1	-0.09	21.731	***
Functional diversity	1	-0.06	7.864	**
Forest type	5	-	35.625	***
Richness × Forest type	5	-	5.720	n.s
R^2		0.39		

Table A5. Results from the generalized linear models testing the effect of the species richness (SR) on the mean number of intraspecific neighbors calculated for pooling all species from all forests at different radius (from 3 m to 15 m). Bold figures highlight the 'fine' (3.5 m) and 'medium' (7.5 m) scale used in our study.

r	**SR**	**LR χ^2**	**Pr (>χ^2)**
3.0	-0.010034	0.428	0.51300
3.5	**-0.031876**	**3.826**	**0.05047**
4.0	-0.042448	6.267	0.01230
4.5	-0.053953	9.329	0.00226
5.0	-0.061973	11.423	0.00073
5.5	-0.075316	15.989	0.00006
6.0	-0.085646	20.573	0.00001
6.5	-0.094433	23.852	0.00000
7.0	-0.102780	27.791	0.00000
7.5	**-0.108526**	**30.700**	**0.00000**
8.0	-0.114631	33.345	0.00000
8.5	-0.121728	35.789	0.00000
9.0	-0.128407	39.013	0.00000
9.5	-0.131783	40.260	0.00000
10.0	-0.136811	41.488	0.00000
10.5	-0.139874	41.638	0.00000
11.0	-0.143413	43.834	0.00000
11.5	-0.146331	45.587	0.00000
12.0	-0.149813	47.101	0.00000
12.5	-0.153164	48.726	0.00000
13.0	-0.154826	49.406	0.00000
13.5	-0.156151	49.443	0.00000
14.0	-0.160449	51.936	0.00000
14.5	-0.162660	53.277	0.00000
15.0	-0.163498	53.326	0.00000

Table A6. Optimum model and set of competing models (ΔAICc < 2) testing the effect of species richness (SR), functional diversity (FD), the median value of the tree sizes measured as basal area (BAmed.), stand structure (SS: used as a proxy of the legacy of past management practices in each forest stand) and forest type (FT) on observed spatial pattern of trees (DR_K and DR_G) and statistic $DR_{k_{mm}}$ quantifying the spatial correlation in tree sizes. Df: degree of freedom, AICc = Akaike Information Criteria for limited sample sizes (AICc), ΔAICc: difference in AICc between models and the optimum. Weight: Akaike weights can be interpreted as the probability that model is the best model for the observed data, given the candidate set of models. R^2: coefficient of determination for the optimum model. (+): predictor included in the model.

	Intercept	**SR**	**FD**	**BAmed**	**SS**	**FT**	**SR*SS**	**SR*FT**	Df	AICc	ΔAICc	Weight	R^2
Medium scale													
DR_K													
Model 1	-33.13			-2393	+	+			10	2664.3	0.00	0.516	0.53
Model 2	-92.11			-2685		+			8	2665.5	1.15	0.289	
Model 3	-50.22	+3.52		-2377	+	+			11	2666.3	1.95	0.195	
DR_G													
Model 1	-34.49		+2.30	-334.6		+			9	1980.7	0.00	0.298	0.37
Model 2	-38.97	+2.01		-335.0		+			9	1980.7	0.01	0.297	
Model 3	-31.77			-350.3		+			8	1981.1	0.41	0.243	
Model 4	-38.57	+1.38	+1.58	-329.0		+			10	1982.0	1.24	0.161	
$DR_{k_{mm}}$													
Model 1	-109.80			ni	+	+			9	2392.9	0.00	0.341	0.12
Model 2	-131.70	+4.56		ni	+	+			10	2393.3	0.46	0.271	
Model 3	-118.30		+4.56	ni	+	+			10	2393.7	0.82	0.227	
Model 4	-69.94			ni		+			7	2394.4	1.50	0.161	
Fine scale													
DR_K													
Model 1	-87.05	+4.76		-790.0	+	+			11	2349.3	0.00	0.354	0.45
Model 2	-63.92			-811.9	+	+			10	2349.4	0.12	0.333	
Model 3	-70.30		+3.27	-789.8	+	+			11	2350.8	1.48	0.169	
Model 4	-124.30	+6.40		-923.0		+			9	2351.1	1.80	0.144	
DR_G													
Model 1	-29.42			-274.08	+	+			10	1854.5	0.00	0.222	0.50
Model 2	-34.89	+ 1.13		-268.89	+	+			11	1855.3	0.82	0.147	
Model 3	-45.41	+ 1.59		-305.09		+			9	1855.9	1.46	0.107	
Model 4	-31.13		+ 0.87	-268.18	+	+			11	1856.0	1.56	0.101	
Model 5	-42.79	+ 3.91		-240.64	+	+		+	16	1856.5	1.98	0.082	
$DR_{k_{mm}}$													
Model 1	-92.12			ni	+	+			9	2288.5	0.00	0.277	0.10
Model 2	-100.40		+4.42	ni	+	+			10	2288.5	0.04	0.271	
Model 3	-64.17			ni		+			7	2289.0	0.58	0.207	
Model 4	-103.80	+2.42		ni	+	+			10	2289.9	1.40	0.138	
Model 5	-66.89		+2.748	ni		+			8	2290.3	1.89	0.108	

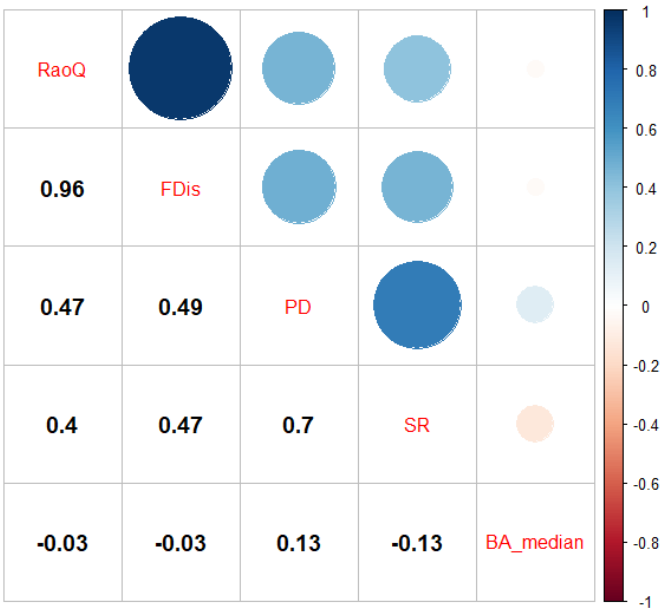

Figure A1. Correlation structure of the predictors. Spearman´s rank correlation of variables is shown. Positive and negative correlation is indicated in blue and red circles, respectively. RaoQ index: Rao's quadratic entropy as a measure of functional diversity. FDis: functional dispersion. PD: phylogenetic diversity. SR: species richness and BA_median: median value of basal areas for each plot.

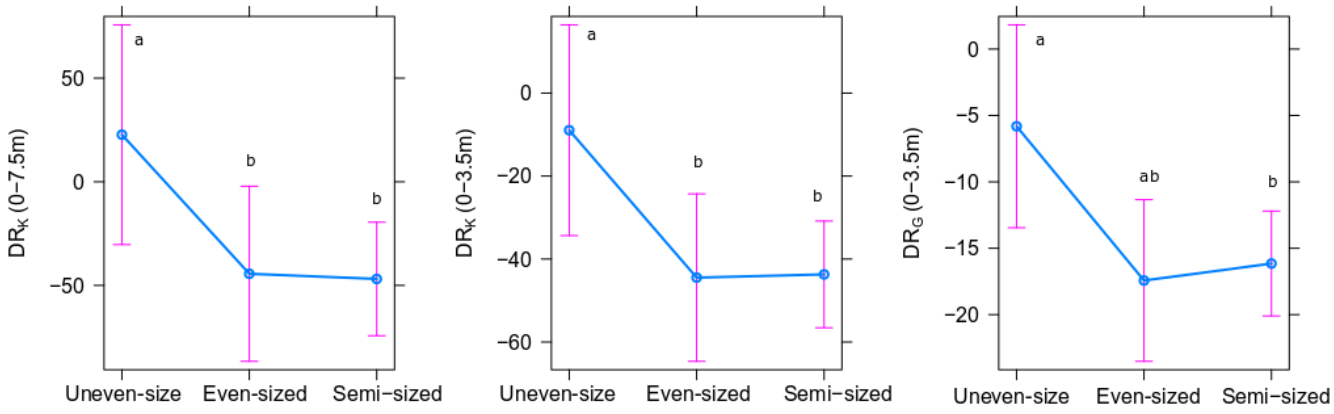

Figure A2. Stastistics of DR_K (K-Ripley) and DR_G (nearest-neighbor) quantifying the net deviation of the observed spatial pattern from a random spatial pattern at two different scales [Fine: 0-3.5 m and medium: 0-7.5 m] for each forest stand structure type (used as a proxy of the legacy of past management practices). Letters indicate forest structures without significant differences in spatial pattern (Results from Tukey's post hoc tests). The graph DR_G at medium scale is not included as variable 'stand structure' was not selected in the best model (Table A6).

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