

Supplementary Material

Tab. S1 - Simplified overview of existing structural indices grouped by inventory technology and the degree of complexity. Modified after Reich et al. (2021). SHI_{CONV} – index of structural heterogeneity (based on data from conventional inventory); SSCI – stand structural complexity index; SHI_{TLS} – structural heterogeneity index (based on data from terrestrial laser scanning).

Degree of complexity	Method of the data acquisition	
	Conventional inventory	Terrestrial laser scanning
basic and simple	Gini coefficient (Gini 1912) Shannon's Index (Shannon 1948)	SSCI (Ehbrecht et al. 2017)
complex and comprehensive	SHI _{CONV} (Sabatini et al. 2015)	SHI _{TLS} (Reich et al. 2021)

Tab. S2 - Characteristics of the 12 forest stand types in the two study areas NE Hesse and Lusatia. All data represent the mean values \pm standard deviation. n = numbers of plots; DBH = diameter at breast height; BA = basal area per hectare; N = number of stems per hectare. pw = pole wood; ifs = immature forest stands; mfs = mature forest stands. OCTS: other coniferous tree species; PADTS: pine with admixed deciduous tree species.

Study Area	Species	Stand type	n	Age (yrs)	DBH (cm)	BA (m ² ha ⁻¹)	N (no. ha ⁻¹)
Hesse	Beech (<i>Fagus sylvatica</i>)	pw	7	33.1 \pm 7.8	13.0 \pm 4.5	14.7 \pm 8.8	1405 \pm 978
		ifs	7	89.8 \pm 20.4	25.8 \pm 8.1	21.3 \pm 4.7	224 \pm 100
		mfs	8	115.4 \pm 47.0	43.2 \pm 16.9	18.5 \pm 9.1	166 \pm 138
	Spruce (<i>Picea abies</i>)	pw	7	35.4 \pm 18.9	15.6 \pm 9.0	23.1 \pm 8.4	600 \pm 467
		ifs	6	43.1 \pm 4.2	24.5 \pm 4.9	32.6 \pm 3.7	508 \pm 126
		mfs	7	99.3 \pm 21.9	47.1 \pm 7.6	29.3 \pm 12.7	177 \pm 118
	OCTS	ifs	6	70.0 \pm 29.1	28.5 \pm 9.8	20.9 \pm 3.1	457 \pm 125
		mfs	6	110.9 \pm 18.4	46.5 \pm 14.6	23.3 \pm 3.5	133 \pm 18
	Lusatia	Pine (<i>Pinus sylvestris</i>)	pw	8	33.5 \pm 7.6	14.9 \pm 5.7	21.9 \pm 4.2
ifs			7	53.2 \pm 6.1	26.7 \pm 6.3	24.6 \pm 5.7	480 \pm 71
mfs			7	95.0 \pm 2.0	33.8 \pm 10.3	25.7 \pm 7.5	146 \pm 89
PADTS		ifs	8	48.6 \pm 5.7	25.7 \pm 5.7	27.7 \pm 5.6	288 \pm 69

Reich KF, Kunz M, Bitter AW, Von Oheimb G (2022).

Do different indices of forest structural heterogeneity yield consistent results?

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Tab. S3 - Definition of the individual structural attributes of the SHI_{CONV}.

Attribute SHI_{CONV}	Definition
living volume	Cubic meters of the living stock
number of trees with DBH > 40 cm	Number of trees with a minimum diameter at breast height of 40 cm
DBH diversity Gini-Simpson index	Diversity index according to Gini-Simpson of the diameter at breast height
tree height (standard deviation)	Standard deviation of the tree height
coarse woody debris (CWD) index	Index to deadwood occurrence as a function of the degree of decomposition and frequency, according to McElhinny et al. (2006)
tree species richness	Number of occurring tree species
basal area of standing deadwood	minimum diameter > 5 cm
volume total deadwood	Cubic meters of lying and standing deadwood

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Tab. S4 - Definition of the individual structural attributes of the SHI_{TLS} . To avoid age-dependent effects, Reich et al. (2021) did not use the media or the mean but relied on the range (difference between the highest and lowest value), the Gini coefficient (GC) and the coefficient of variation (CV).

Attribute SHI_{TLS}	Definition
crown density (range)	Ratio crown volume (Volume of the alpha hull around the 3D points of the tree crown between crown base height and tree height) to branch wood volume
ratio crown width to crown length (CV)	Ratio of maximum crown width on the x-y plane to the crown length (length between CBH and tree height)
CBH (GC)	Crown base height: Length between the base of the trunk and the first large branch
volume of branches of 1st, 2nd, and 3rd order (range)	Summed up volume [m ³] of all tree branches up to the third order
ratio crown displacement to height (range)	Crown displacement: Projected deviation of crown tip from crown base, viewed from above
crown surface area (GC)	Surface area of the alpha shell around the 3D points of the tree crown between CBH and tree height
ratio crown area to crown volume (CV)	Crown area: Area of the perpendicularly projected crown on the ground; crown volume: Volume of the alpha hull around the 3D points of the tree crown between CBH and tree height
crown sinuosity (GC)	Average deviation of the stem from the ideal straight crown base to crown tip

Tab. S5 - Descriptive analysis of the Gini coefficient (diameter breast height). Stand type: pw – pole wood, ifs – immature forest stands, mfs – mature forest stands, OCTS – forest stands with coniferous tree species, PADTS – pine forest stands with admixed deciduous tree species.

Study Area	Species	Stand type	Gini coefficient of diameter at breast height				
			Median	Mean	Minimum	Maximum	Range
NE Hesse	Beech (<i>Fagus sylvatica</i>)	pw	0.18	0.17	0.06	0.29	0.23
		ifs	0.23	0.21	0.06	0.31	0.24
		mfs	0.12	0.15	0.02	0.39	0.37
	Spruce (<i>Picea abies</i>)	pw	0.16	0.19	0.11	0.30	0.19
		ifs	0.14	0.18	0.10	0.28	0.18
		mfs	0.22	0.25	0.08	0.46	0.38
	OCTS	ifs	0.24	0.21	0.03	0.31	0.28
		mfs	0.13	0.12	0.03	0.21	0.18
Lusatia	Pine (<i>Pinus sylvestris</i>)	pw	0.16	0.15	0.10	0.23	0.13
		ifs	0.13	0.19	0.09	0.43	0.34
		mfs	0.07	0.08	0.05	0.14	0.09
	PADTS	dts	0.29	0.27	0.22	0.34	0.11

Tab. S6 - Descriptive analysis of the Gini coefficient (tree height). Stand type: pw – pole wood, ifs – immature forest stands, mfs – mature forest stands, OCTS – forest stands with coniferous tree species, PADTS – pine forest stands with admixed deciduous tree species.

Study area	Species	Stand type	Gini coefficient of tree height				
			Median	Mean	Minimum	Maximum	Range
NE Hesse	Beech (<i>Fagus sylvatica</i>)	pw	0.07	0.07	0.01	0.19	0.17
		ifs	0.06	0.08	0.00	0.21	0.21
		mfs	0.07	0.08	0.04	0.16	0.13
	Spruce (<i>Picea abies</i>)	pw	0.05	0.08	0.00	0.18	0.18
		ifs	0.10	0.08	0.01	0.18	0.17
		mfs	0.11	0.13	0.00	0.24	0.24
	OCTS	ifs	0.06	0.11	0.02	0.26	0.23
		mfs	0.07	0.10	0.03	0.20	0.17
Lusatia	Pine (<i>Pinus sylvestris</i>)	pw	0.01	0.04	0.01	0.15	0.14
		ifs	0.12	0.11	0.05	0.18	0.12
		mfs	0.01	0.01	0.01	0.03	0.03
	PADTS	dts	0.18	0.18	0.08	0.29	0.21

Tab. S7 - Descriptive analysis of the Shannon index. Stand type: pw – pole wood, ifs – immature forest stands, mfs – mature forest stands, OCTS – forest stands with coniferous tree species, PADTS – pine forest stands with admixed deciduous tree species.

Study area	Species	Stand type	Shannon index				
			Median	Mean	Minimum	Maximum	Range
NE Hesse	Beech (<i>Fagus sylvatica</i>)	pw	0.61	0.52	0.00	1.20	1.20
		ifs	0.00	0.43	0.00	1.50	1.50
		mfs	0.78	0.79	0.00	2.25	2.25
	Spruce (<i>Picea abies</i>)	pw	0.00	0.38	0.00	1.25	1.25
		ifs	0.00	0.33	0.00	1.15	1.15
		mfs	0.85	0.90	0.00	1.90	1.90
	OCTS	ifs	0.76	0.79	0.00	1.85	1.85
		mfs	1.26	1.32	0.86	1.92	1.06
	Lusatia	Pine (<i>Pinus sylvestris</i>)	pw	0.00	0.06	0.00	0.29
ifs			0.00	0.23	0.00	0.86	0.86
mfs			0.00	0.00	0.00	0.00	0.00
PADTS		dts	1.24	1.38	0.99	1.94	0.95

Tab. S8 - Descriptive analysis of the SHICONV. Stand type: pw – pole wood, ifs – immature forest stands, mfs – mature forest stands, OCTS – forest stands with coniferous tree species, PADTS – pine forest stands with admixed deciduous tree species.

Study Area	Species	Stand type	SHI _{CONV}				
			Median	Mean	Minimum	Maximum	Range
NE Hesse	Beech (<i>Fagus sylvatica</i>)	pw	48.66	43.39	16.94	61.88	44.93
		ifs	40.44	43.66	29.57	61.59	32.02
		mfs	54.06	55.09	45.17	66.06	20.89
	Spruce (<i>Picea abies</i>)	pw	36.15	38.74	20.95	59.83	38.89
		ifs	38.39	40.33	26.98	59.45	32.47
		mfs	66.14	60.74	40.93	77.36	36.43
	OCTS	ifs	60.61	58.12	28.82	82.89	54.07
		mfs	69.35	68.99	59.87	77.40	17.52
	Lusatia	Pine (<i>Pinus sylvestris</i>)	pw	30.64	31.48	24.65	42.66
ifs			47.85	48.77	31.78	67.40	35.62
mfs			32.06	32.51	28.04	37.28	9.24
PADTS		dts	72.65	72.81	57.31	88.83	31.52

Tab. S9 - Descriptive analysis of the SHI_{TLS}. Stand type: pw – pole wood, ifs – immature forest stands, mfs – mature forest stands, OCTS – forest stands with coniferous tree species, PADTS – pine forest stands with admixed deciduous tree species.

Study Area	Species	Stand Type	SHI _{TLS}				
			Median	Mean	Minimum	Maximum	Range
NE Hesse	Beech (<i>Fagus sylvatica</i>)	pw	58.13	59.36	36.91	84.59	47.69
		ifs	39.41	42.11	6.54	77.67	71.13
		mfs	52.12	48.91	36.48	57.64	21.16
	Spruce (<i>Picea abies</i>)	pw	30.08	33.85	19.51	62.37	42.86
		ifs	38.39	40.33	26.98	59.45	32.47
		mfs	45.20	45.75	26.96	70.31	43.36
	OCTS	ifs	49.49	46.89	23.76	61.25	37.49
		mfs	50.44	47.31	26.58	61.77	35.19
	Lusatia	Pine (<i>Pinus sylvestris</i>)	pw	51.82	47.79	30.75	62.74
ifs			55.10	57.20	47.65	71.96	24.31
mfs			63.82	59.97	37.45	76.75	39.30
PADTS		dt	59.85	65.76	51.01	85.47	34.46

Tab. S10 - Descriptive analysis of the SSCI. Stand type: pw – pole wood, ifs – immature forest stands, mfs – mature forest stands, OCTS – forest stands with coniferous tree species, PADTS – pine forest stands with admixed deciduous tree species.

Study Area	Species	Stand Type	SSCI				
			Median	Mean	Minimum	Maximum	Range
NE Hesse	Beech (<i>Fagus sylvatica</i>)	pw	1.86	2.23	0.95	4.01	3.06
		ifs	2.67	2.96	2.09	4.55	2.47
		mfs	3.24	3.50	2.79	5.25	2.45
	Spruce (<i>Picea abies</i>)	pw	2.68	2.67	1.86	4.29	2.43
		ifs	2.15	2.32	1.12	3.83	2.71
		mfs	2.32	2.41	1.10	4.39	3.28
	OCTS	ifs	2.85	3.01	2.25	4.19	1.94
		mfs	2.67	2.62	2.38	2.76	0.38
	Lusatia	Pine (<i>Pinus sylvestris</i>)	pw	3.27	3.14	2.33	3.90
ifs			3.25	3.25	2.80	3.50	0.70
mfs			2.90	2.99	2.56	3.59	1.04
PADTS		dts	2.92	3.05	1.64	4.55	2.91

Tab. S11 - Differences between age classes within the four groups of forest stand types were examined using analysis of variance (ANOVA) followed by post-hoc analysis (Tukey’s test). GC – Gini coefficient, H_s – Shannon index, SHI_{CONV} – conventional structural heterogeneity index, SHI_{TLS} – structural heterogeneity index terrestrial laser scanning, SSCI – stand structural complexity index, DBH – diameter at breast height, H – tree height, pw – pole wood, ifs – immature forest stands, mfs – mature forest stands, OCTS – forest stands with other coniferous tree species. Bold numbers represent significant differences.

Species	Age classes		p-value for each index					
			GC_{DBH}	GC_H	H_s	SHI_{CONV}	SSCI	SHI_{TLS}
<i>Fagus sylvatica</i>	pw	ifs	0.7597	0.9551	0.9623	0.9814	0.3608	0.2387
	ifs	mfs	0.5110	0.9977	0.3789	0.1930	0.5468	0.7755
	mfs	pw	0.9102	0.9337	0.5252	0.2874	0.0531	0.5553
<i>Picea abies</i>	pw	ifs	0.9798	0.9968	0.9874	0.9966	0.8191	0.9977
	ifs	mfs	0.3522	0.5299	0.2230	0.0557	0.9859	0.4311
	mfs	pw	0.3893	0.4242	0.2232	0.0508	0.8781	0.3344
OCTS	ifs	mfs	0.2188	0.8267	0.1858	0.3633	0.2998	0.9649
<i>Pinus sylvestris</i>	pw	ifs	0.6855	0.0067	0.2631	0.0025	0.8542	0.2807
	ifs	mfs	0.0404	0.0006	0.1165	0.0054	0.4258	0.8955
	mfs	pw	0.1671	0.4842	0.8466	0.9705	0.7195	0.1304